Form Number A6206

Part Number D301232X012 February 2007

# FloBoss 107 Flow Manager Instruction Manual



**Remote Automation Solutions** 

#### **Revision Tracking Sheet**

#### February 2007

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Page Initial issue Revision Feb-07

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#### Appendix A – Glossary

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## **Chapter 1 – General Information**

This manual describes the FloBoss<sup>™</sup> 107 Flow Manager ("FB107"), part of the family of FloBoss flow computers manufactured by Remote Automation Solutions, a division of Emerson Process Management. For information about the software you use to configure the FB107, refer to the *ROCLINK*<sup>™</sup> 800, *Configuration Software User Manual (for FloBoss* 107) (Form A6217).

This chapter provides an overview of the FB107 and its components.

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#### 1.1 Scope of Manual

Chapter 1 General Information	Provides an overview of the hardware and firmware for the FB107 base unit and the expansion rack.
Chapter 2 Installation and Use	Provides information on installation, tools, wiring, and other essential elements of the FB107.
Chapter 3 Power Connections	Provides information on determining power requirements for the FB107.
Chapter 4 Inputs/Outputs and RTD Inputs	Provides information for the input/output (I/O) modules, CPU I/O assembly, and the RTD input.
Chapter 5 Communications	Provides information for the built-in communications and the optional communication modules.
Chapter 6 Multi-Variable Sensor (MVS)	Provides information for the optional MVS module.
Chapter 7 Troubleshooting	Provides information on diagnosing and correcting problems.
Glossary	Provides definitions of acronyms and terms.
Index	Provides an alphabetic listing of items and topics contained in this manual.

This manual contains the following chapters:

#### 1.2 FloBoss 107 Overview

A 32-bit microprocessor-based electronic flow computer, the FB107 electronically measures, monitors, and manages flow. This economical flow computer reliably and accurately performs flow calculations, temperature measurements, and data archival.

Note: You configure the functionality of the FB107 and monitor its operation using a personal computer (PC) running ROCLINK<sup>™</sup> 800 ("ROCLINK 800") software.

The FB107 can measure up to four meter runs through a variety of devices, such as an orifice plate, turbine meter, or other pulse-generating devices. Meter inputs may also use analog transmitters. For multiple differential pressure-run applications, you can add an optional Multiple-Variable Sensor (MVS) module to provide an interface to remote MVS transmitters.

The FB107 performs minute, hourly, daily, and minimum / maximum historical data archival for standard history and a configurable time interval archival for extended history. The solution to electronically replace traditional paper charting, the FB107 records the corrected flow for differential or pulse counts and stores the data.

The FB107 computes flow for both volume and energy. It provides onsite functionality and supports remote monitoring, measurement, data archival, communications, and control. It stores the results of the flow calculations in memory and can be communicated to an external device either on demand or periodically.

The FB107 design allows you to configure specific applications, including those requiring logic and sequencing control using a Function Sequence Table (FST).



Figure 1-1. FloBoss 107 Base Unit



Figure 1-2. FloBoss 107 Expansion Rack



Figure 1-3. FloBoss 107 with Expansion Rack

The FB107 provides the following components and features:

- 32-bit processor board, inter-connect board, and backplane board.
- Central processing unit (CPU).
- Field upgradeable 2 MB flash ROM (read only memory).
- 2 MB battery backed-up RAM (random access memory) storage.
- Two-, three-, or four-wire 100-ohm resistance thermal device (RTD) input.
- Battery and super-capacitor backed memory retention to provide short and longer-term data, configuration, and operational integrity when the FB107 is not in service or is in storage.
- Three built-in communication ports.
- Input power and output loop power.
- Extensive applications firmware.

#### 1.3 Hardware

The FB107 is available with four basic configurations:

- Non-isolated CPU without I/O.
- Non-isolated CPU with six points of I/O.
- Isolated CPU without I/O.
- Isolated CPU with six points of I/O.

Note: Isolation occurs between the CPU and the field logic.

The FB107 base unit has four slots. Slot 0 is reserved for the CPU module, which provides three communication ports, an RTD, power input, loop power output, system variables, and optional 6 points of I/O.

Slots 1 and 2 can each contain one communication module. Slots 1, 2, and 3 can contain input/outputs (I/O), MVS, and smart application modules.

#### 1.3.1 Processor and Memory

The FB107 derives processing power from a 32-bit CMOS microprocessor. The microprocessor features a single 32-bit internal data bus and a single 16-bit external data bus. The microprocessor has low-power operating modes, including inactivity and low battery condition. The FB107 has high-speed direct memory access.

The FB107 has 2 MB of static random access memory (SRAM) for storing database, historical, configuration, alarms, and events data.

#### 1.3.2 Backplane

The backplane board routes signals to and from the CPU to the I/O modules, smart application modules, expansion rack, the Multi-Variable Sensor, and communication modules.

#### 1.3.3 Expansion Rack

The expansion rack enables the FB107 to expand its I/O capabilities to meet your needs. You can add an optional expansion rack to increase I/O by four slots. The FB107 can have up 42 points of I/O. The expansion rack supports optional I/O, MVS, and smart application modules.

### 1.3.4 Central Processing Unit (CPU)

The base unit on the FB107 has four slots. Slot 0 is for the CPU module. The CPU provides connections to the field wiring including surge and static discharge protection for the field wiring. Electronics include the RTD circuits and the final I/O drivers/receivers.

The CPU components include:

- RTD input.
- Input power.
- Loop power output.
- Reset (RST) switch.
- System variables.
- Diagnostic monitoring.
- Real-time clock.

- Automatic self-tests.
- Power saving modes.
- Local operator interface (LOI) EIA-232 (RS-232).
- EIA-485 (RS-485) communications (COM1).
- EIA-232 (RS-232) communications (COM2).
- Boot Flash System initialization and diagnostics.
- SRAM (static random access memory) with battery backup Data logs and configuration.
- Flash ROM (Read-only memory) Firmware image.
- 32-bit microprocessor and the real-time operating system (RTOS) provide both hardware and software memory protection.
- Optional CPU I/O assembly and terminations (see Figure 1-4).



Figure 1-4. CPU

### 1.3.5 Battery and Super-capacitor

A super capacitor ("super-cap") and a coin type battery work together to provide backup power for the static RAM and the real-time clock. This helps to ensure retention of short and longer-term data, configuration, and operational integrity when the FB107 is not in service or is in storage.

For information on replacing the battery, refer to *Section 2.5.1*, *Removing and Installing the Battery*.

**Note:** The super-cap is not field-replaceable.

### 1.3.6 Built-in Inputs and Outputs

The built-in inputs and outputs (I/O) on the CPU consist of a 3- or 4wire 100-ohm resistance thermal detector (RTD) input interface and five diagnostic analog inputs (AI) that monitor the:

- Logical voltage.
- Battery voltage from the backplane voltage input connector.
- Charge in voltage originating from the CPU power input.
- System milliamps originating from the power input from the CPU.
- Board temperature originating at the CPU.

#### **1.3.7 Built-in Communications**

The FB107 supports up to four communication ports. The base CPU has three built-in communication ports:

- Local Operator Interface (RS-232C) LOI for asynchronous serial communication (Local Port).
- EIA-485 (RS-485) COM1 for asynchronous serial communication.
- EIA-232 (RS-232) COM2 for serial communication.

Local OperatorThe Local Operator Interface (LOI) port provides for a direct, localInterface Portlink between the FB107 and a personal computer (PC) through an<br/>optional Local Operator Interface Cable using EIA-232 (RS-232C)<br/>communications.

The LOI local port allows you to access the FB107 for configuration and transfer of stored data. The LOI port is capable of initiating a message in support of Spontaneous-Report-by-Exception (SRBX) alarming.

The LOI is software-configurable with baud rates from 300 to 115.2 K and it uses a DB9 connection.

Note: You can purchase an LOI cable from your sales representative.

	The LOI supports ROC or Modbus slave protocol communications. The LOI also supports the log-on security feature of the FB107, if you enable the security on LOI using ROCLINK 800.	
	Default values for the LOI port are: 19,200 baud rate, 8 data bits, 1 stop bit, no parity, group 1, and address 2.	
EIA-485 (RS-485) Serial Communications COM1	COM1 provides EIA-485 (RS-485) serial communication protocols with baud rates from 300 to 115.2 K. COM1 provides standard differential data transmissions over distances of up to 1220 meter (4000 feet).	
	The EIA-485 (RS-485) drivers are designed for true multi-point applications with multiple devices on a single bus.	
	Note: COM1 is labeled 485 on the CPU.	
	Use COM1 to monitor or modify the FB107 from a remote site, using a host or ROCLINK 800. COM1 also supports the log-on security feature of the FB107 if you enable the security on COM1 using ROCLINK 800.	
	COM1 sends and receives messages using the ROC or Modbus slave and host protocol. COM1 is capable of initiating a message in support of Spontaneous-Report-by-Exception (SRBX) alarming.	
	Default values for the EIA-485 (RS-485) communications are: 19,200 baud rate, 8 data bits, 1 stop bit, no parity, 10 millisecond key-on delay, and 10 millisecond key-off delay. The maximum baud rate is 115.2 Kbps.	
EIA-232 (RS-232) Serial Communications COM2	COM2 allows for EIA-232 (RS-232) asynchronous serial communication protocols with baud rates from 300 to 115.2 K, host serial interface. COM2 provides standard single-ended data transmission over distances of up to 15 meter (50 feet).	
	Use COM2 to monitor or alter the FB107 from a remote site, using ROCLINK 800. COM2 also supports the log-on security feature of the FB107 if the security on COM2 is enabled in ROCLINK 800.	
	COM2 sends and receives messages using the ROC or Modbus slave or host protocol. COM2 is capable of initiating a message in support of Spontaneous-Report-by-Exception (SRBX) alarming.	
	Default values for the EIA-232 (RS-232) communications module are: 19,200 baud rate, 8 data bits, 1 stop bit, no parity, 10 millisecond key-on delay, and 10 millisecond key-off delay. The maximum baud rate is 115.2 Kbps.	
	<b>Note:</b> When you install a <b>communications module</b> in slot 2, the firmware redirects communications port (COM2) on the CPU to the type of module installed in slot 2. Configure COM2 based on the type of communication module installed in slot 2.	

### **1.3.8 Built-in Resistance Thermal Device (RTD)**

The FB107 supports a direct input from a resistance thermal device (RTD) sensor to measure flowing temperature. An RTD temperature probe typically mounts in a thermowell on the meter run. The RTD has a measurement range of -40 to  $400^{\circ}$ C (-40 to  $752^{\circ}$ F). The RTD is located on the CPU.

### 1.3.9 Built-in Loop Output Power

Using ROCLINK 800, you can configure the I/O on the CPU module's optional I/O assembly to set the loop output power to 10 volts dc or 24 volts dc. The I/O module only supports 24 Volts dc loop output power.

**Note:** The CPU I/O assembly uses the CPU's loop power output and ground connections.

The intent of the loop output power is to power devices that require 24 volts dc to ground allowing the external device to send the FB107 a 4 to 20 mA signal based on pressure, temperature, level, and such.

The 10-volt loop output power is intended for low power transmitters. The loop current is designed to deliver 80 mA to power two field devices that connect back to the two analog inputs.

### **1.3.10 Optional Inputs and Outputs**

The input/output (I/O) options for the FB107 provide terminals for expanded monitoring and control applications. I/O can be used to drive a sampler or odorizer, open a valve, or monitor an additional analog input.

You can order the expanded 6-point I/O as an:

- I/O assembly that mounts directly on the CPU module (optional I/O assembly).
- I/O modules that mount in the I/O slots.

Both configurations provide terminations for six points of I/O and both provide the same selections for I/O. You can configure five of the six points of I/O are configurable using ROCLINK 800 software.

The six points of I/O consists of:

- Two analog inputs (AI) or discrete inputs (DI).
- One analog output (AO) or discrete output (DO).
- One discrete output (DO).
- Two pulse inputs (PI) or discrete inputs (DI).

You can add an expansion rack to the FB107 base unit to increase I/O by four slots for a total of six slots of I/O. The FB107 supports up to six

 $\rm I/O$  modules and one CPU I/O assembly, and can have up to 42 points of I/O.

You can install I/O modules in slots 1 through 3 on the FB107 base unit and in slots 4 through 6 on the expansion rack. If you install a communications module in slot 1, you can install an I/O module in slot 7.

You can use current analog inputs of 4 to 20 mA when you select the 250-ohm resistor in the AI configuration using ROCLINK 800.

### **1.3.11 Optional Communication Module – COM3**

One optional communication module provides the ability to send and receive data through COM3. The COM3 port is capable of initiating a message in support of Spontaneous-Report-by-Exception (SRBX) alarming.

You can install communication modules in slots 1 or 2 on the base unit. Installing a communications module in slot 1 on the base unit activates the COM3 communications port. Installing a communications module in slot 2 redirects the CPU's communications port (COM2) to the type of module installed in slot 2.

The FB107 accommodates one of the following communication modules types:

- EIA-485 (RS-485) serial communication protocols with baud rates from 300 to 115.2 Kbps to provide standard differential data transmissions over distances of up to 1220 meter (4000 feet).
- EIA-232 (RS-232) serial communication protocols with baud rates from 300 to 115.2 Kbps, host serial interface to provide standard single-ended data transmission over distances of up to 15 meter (50 feet).

COM3 can communicate with other devices using ROC or Modbus host and slave protocols. The firmware can automatically detect ROC or Modbus slave protocols.

### 1.3.12 Optional Multi-Variable Sensor (MVS)

The optional Multi-Variable Sensor (MVS) module provides differential pressure, static pressure, and temperature inputs to the FB107 for differential pressure flow calculation.

You can install only one MVS module in the FB107. You can install the MVS module in slots 1 through 3 on the base unit or in slots 4 through 7 on the expansion rack, regardless of the position of any other type of module.

The MVS module provides current-limited power and EIA-485 (RS-485) communications to external remote MVS transmitters. The FB107 supports six remote transmitters with up to four meter runs.

### 1.3.13 Optional License Key

The optional application license key provides extended functionality, such as the use of various user programs. The FB107 supports up to different six user programs. For example, you need to install a license key with the proper license in the FB107 to run User C programs.

#### 1.4 Firmware

The firmware makes extensive use of configuration parameters, which you manage using ROCLINK 800 software. The firmware contained in flash ROM on the processor board, determines the FB107's functionality.

The firmware provides a complete operating system for the FB107, and is field-upgradeable using a serial connection such as the LOI port.

Firmware includes:

- Input and output database.
- Historical database.
- Event and alarm log database.
- Applications, such as PID, AGA, and FST.
- Real-time clock.
- Determining task execution.
- 1992 AGA-3 flow calculations (with user-selectable AGA8 compressibility Detail, Gross 1, or Gross 2).
- 1996 AGA-7 flow calculations (with user-selectable AGA8 compressibility).
- ISO5167-2003 flow calculations.
- ROC or Modbus host or slave (ASCII or RTU).
- Memory logging of 240 alarms and 240 events.
- Establishing and managing communications.
- Communications based on the ROC protocol or Modbus slave and host (ASCII or RTU) protocol for use with EFM applications.
- Alarm call-in to host for Spontaneous-Report-By-Exception (SRBX).
- Standard and Extended History.
- Self-test capability.
- User level security.

The FB107 provides the functions required for a variety of field automation applications. Designed for expandability, the FB107 monitors, measures, and controls equipment in a remote environment.

You can use the FB107 for:

- Applications requiring flow computation.
- Logic and sequencing control using a user-defined Function Sequence Table (FST).
- Closed-loop (PID) control capabilities (requires optional I/O module or CPU I/O assembly).
- Custom User C application support.

## **Real-Time Operating** System (RTOS) The FB107 firmware uses a pre-emptive, multi-tasking, message-based real-time operating system (RTOS). Tasks are assigned priorities and, at any given time, the operating system determines which task will run.

For instance, if a lower priority task is executing and a higher priority task needs to run, the operating system suspends the lower priority task, allows the higher priority task to run to completion, then resumes the lower priority task's execution.

**TLP** The FB107 reads data from and writes data to data structures called "points." A "point" is a ROC protocol term for a grouping of individual parameters (such as information about an I/O channel) or some other function (such as a flow calculation). Points are defined by a collection of parameters and have a numerical designation that defines the type of point.

The logical number indicates the physical location for the I/O or the logical instance for non-I/O points within the FB107. Parameters are individual pieces of data that relate to the point type. The point type attributes define the database point to be one of the possible types of points available to the system.

A sample TLP might be analog input (T), rack location B1 (L), and Engineering Units (P).

Together, these three components—the type (**T**), the logical (**L**), and the parameters (**P**)—identify specific pieces of data that reside in an FB107 database. Collectively, this three-component address is often called a **TLP**.

#### 1.4.1 History Points

The FB107 saves history to either of two databases: Standard or Extended History. You can configure the number of entries/logs available to Standard (maximum of 100) and Extended History (maximum of 25). History for meter runs includes the Averaging Techniques as well as accumulation per second and accumulation per minute.

You can select the number of history points to archive, the sample interval in minutes (for Extended or Standard History) or seconds (for Extended History only), the number of days to archive, and whether to log history data at the beginning or the end of the period.

History is one block of memory divided into two areas, one for Standard History and one for Extended History. Standard History uses all of the

memory that it requires for the configured number of points. Extended History only receives the surplus memory not used by the Standard History.

**Standard History** archival properties include:

- Up to 100 points of **minute data** from the last 60 minutes.
- Up to 100 points of **hourly data** for 35 days.
- Up to 100 points of **daily data** for 35 or 60 days.
- Min / max historical data for today and yesterday.

**Extended History** archiving provides a monitoring resolution for the FB107 that is similar to a chart recorder. You can configure Extended History to archive up to 25 history points with archiving intervals at 1, 2, 3, 4, 5, 10, 12, 15, 20, 30, or 60 second or minute intervals.

Minute Historical The FB107 has a 60-minute historical log for every history point. The Log Minute Historical Log stores the last 60 minutes of data from the current minute. Each history point has Minute Historical Log entries, unless the history point is configured for FST-controlled logging.

Hourly Historical The FB107 has a total of 35 days of hourly historical logs available for every history point. The Hourly Historical Log is also called the Periodic database. Normally, the Hourly Log is recorded at the beginning of every hour, although you can configure it for either the beginning or end of every hour. The exceptions are FST Minute and FST Second logging.

The time stamp for periodic logging consists of the month, day, hour, and minute. The exception is for FST Second logging, in which the time stamp consists of the day, hour, minute, and second.

- **Daily Historical** Log The FB107 has a total of 35 or 60 daily historical logs for every history point. The Daily Log is recorded at the configured contract hour every day with a time stamp that is the same as the Hourly Log. Each history point has daily historical log entries, unless the history point is configured for FST-controlled logging.
- Min / Max Historical
   Log
   The Min / Max database displays the minimum and the maximum values for the database points over a 24-hour period for today and yesterday. You can view the Min / Max historical, but not save it to disk.
- **Extended History Log** The FB107 has configurable archive times that, in turn, determine the number of entries. You can configure Extended History to archive up to 25 history points with archiving intervals at 1, 2, 3, 4, 5, 10, 12, 15, 20, 30, or 60 second or minute intervals.

### 1.4.2 Alarm Log

The alarm log contains the change in the state of any alarm signal that has been enabled for alarms. The system alarm log has the capacity to maintain and store up to 240 alarms in a "circular" log. The alarm log has information fields that include time and date stamp, alarm clear or set indicator, and either the tag name of the point or a 14-byte detail string in ASCII format.

In addition to providing functionality for appending new alarms to the log, the alarm log allows host packages to request the index of the most recently logged alarm entry. Alarm logging is available internally to the system, to external host packages, and to FSTs.

**Note:** ROCLINK 800 does not store alarm logs to the flash ROM when you select the Save Configuration function.

The alarm log operates in a circular fashion with new entries overwriting the oldest entry when the buffer is full. The alarm log provides an audit history trail of past alarms. The system stores the alarm log separately from the event log to prevent recurring alarms from overwriting configuration audit data.

### 1.4.3 Event Log

The event log contains changes to any parameter within the FB107 made through the protocol. This event log also contains other FB107 events, such as power cycles, cold starts, and disk configuration downloads. The event log provides an audit history trail of past operation and changes. The event log has information fields that include point type, parameter number, time and date stamp, point number (if applicable), the operator identification, the previous or current parameter values, and either the tag name of the point or a 14-byte detail string in ASCII format.

The system event log has the capacity to maintain and store up to 240 events in a circular log. The event log operates in a circular fashion with new entries overwriting the oldest entry when the buffer is full. The event log provides an audit trail history of past operation and changes. The system stores the event log separately from the alarm log to prevent recurring alarms from overwriting configuration audit data.

In addition to providing functionality for appending new events to the log, the event log allows host packages to request the index of the most recently logged event entry. Event logging is available internally to the system, to external host packages, and to the FST.

**Note:** ROCLINK 800 does not store event logs to the flash ROM when you select the Save Configuration function.

The FB107 has the ability to limit the AGA calculation-related events to only critical events. Selecting **Enabled** in the Limit Meter Events field on the Meter Setup's Advanced tab (**Meter** > **Setup**) keeps the system from filling the event log with unnecessary events. The events **not** logged include temperature, pressure, Reynolds number, and warnings for orifice diameter, pipe diameter, and beta ratio.

### 1.4.4 Security

The FB107 permits device-based security. You can define and store a maximum of 16 log-on identifiers (IDs). In order for the unit to communicate, the log-on ID supplied to ROCLINK 800 software must match one of the IDs stored in the FB107. This security feature is enabled by default on the Local Operator Interface port (Security on LOI). You can configure security protection on COM1, COM2, and COM3, but this security is disabled by default.

#### 1.4.5 I/O Database

The I/O database contains the I/O points the operating system firmware supports, including the system analog inputs and variables, Multi-Variable Sensor (MVS) values, communications, and smart application modules. The firmware automatically determines the point type and point number location of each installed module. It then assigns each input and output to a point in the database and includes user-defined configuration parameters for assigning values, statuses, or identifiers. The firmware scans each input, placing the values into the respective database point. These values are available for display and historical archiving.

### 1.4.6 Function Sequence Tables (FST)

The FB107 supports FST user programmability. You can develop four FST programs with a maximum length of 3000 bytes each. You configure the number of FST lines per execution cycle in ROCLINK 800.

The FST code resides in static RAM and is backed up to flash memory when you issue the Save Configuration function through ROCLINK 800.

Note: You must first enable FSTs (Configure > Control > FST Registers) in order to make them available.

### 1.4.7 PID Control

The PID Control applications firmware provides Proportional, Integral, and Derivative (PID) closed-loop control for a FB107, which enables the stable operation of a feedback control loop that employs a regulating

device, such as a control valve. The FB107 supports eight PID control loops and requires an optional CPU I/O assembly or I/O module.

The firmware sets up an independent PID algorithm (loop) in the FB107. The PID loop has its own user-defined input, output, and override capability.

A PID control loop maintains a process variable at setpoint. If PID override control is configured, the primary loop is normally in control of the regulating device. When the change in output (user-selectable) for the primary loop becomes lesser or greater than the change in output calculated for the secondary (override) loop, the override loop takes control of the regulating device. A typical example is for flow control with a pressure override loop.

**Note:** You must first enable PID control loops (**ROC** > **Information**) in order to make them available.

### 1.4.8 Spontaneous-Report-By-Exception (SRBX) Alarming

The SRBX functionality allows you to set up a communications port that enables the FB107 to contact the host computer when specified alarm conditions exist. To configure SRBX alarming, each communications port must have the SRBX parameter enabled, each point must have the alarming parameter enabled, and points must have an SRBX parameter (SRBX on Set, SRBX on Clear, or SRBX on Set & Clear) selected. SRBX occurs over a serial line if the host is set up for receiving field-initiated calls.

### 1.4.9 Softpoints

**Softpoints** are global data storage areas that any FB107 application can use. For example, a softpoint may store the results of a specified FST calculation or store an intermediate result of a specified value an FST or user program aquires. Softpoints consist of a tag identifier, one integer value, and twenty floating values. Thirty-two softpoints provide storage for over 704 variables.

#### 1.4.10 Opcodes

Use the **Opcode Table** to group data being polled for more efficient communications. You can assign parameters from different point types can be assigned to the opcode table data points, which can substantially reduce the number of polls from a host computer. The FB107 supports eight opcode tables, each with 44 values.

### 1.4.11 Pass Through Communications

By using the FB107 communications ports, Pass Through Communications mode allows one unit to receive data and then pass it through to other devices connected on any other communications port.

For example, the host communicates via a radio on the FB107 COM2 port. Other FB107 units can then be connected via EIA-485 (RS-485) on the COM1 port of the first FB107, and then all the FB107 units can use the one radio to communicate to the host.

Note: The Device Group of the FB107 receiving the data must match the Device Group of the FB107s to which the data is passed. The Device Group is located on the Information screen (**ROC** > Information).

### 1.4.12 ROC and Modbus Protocols

The FB107 has the capability to communicate with other devices using ROC or Modbus protocols. The firmware can automatically detect the two protocols (ROC or Modbus) at baud rates of up to 115.2 Kbps bps.

ROC protocol supports serial communications to local or remote devices, such as a host computer.

An FB107 can act as a Modbus host or slave device using either Remote Terminal Unit (RTU) or American Standard Code for Information Interchange (ASCII) modes. This allows you to easily integrate the FB107 into other systems. Extensions to the Modbus protocol allow the retrieval of history, event, and alarm data in Electronic Flow Metering (EFM) Measurement applications.

#### Notes:

- The LOI port only supports ROC or Modbus slave protocols.
- The FB107 auto-detects either ROC or Modbus slave protocol messages on all comm ports. To enable Modbus host on a particular comm port, you must select Modbus host as the port owner. As a Modbus host, the comm port then **does not** support ROC protocol messages.

### 1.4.13 User C Programs

Optionally, you can order custom application programs developed in User C to provide functionality not included in the firmware, such as calculations for steam and custom communication drivers. Examples of custom User C programs include:

- Flow calculation.
- Properties calculations.

- Communications programs.
- Special applications.

You can transfer licenses for User C programs to the FB107 using ROCLINK 800's License Key Administrator function (**Utilities** > **License Key Administrator**).

#### 1.5 ROCLINK 800 Configuration Software

ROCLINK 800 Configuration software is a Microsoft<sup>®</sup> Windows<sup>®</sup>-based program that runs on a PC and enables you to monitor, configure, and calibrate the FB107.

Many of the configuration screens, such as meters, I/O, and PIDs, are available while ROCLINK 800 is off-line. This enables you to configure the system while either on-line or off-line with the FB107.

The Local Operator Interface (LOI local port) provides a direct link between the FB107 and a PC. The LOI port uses a DB9 connector with standard EIA-232 (RS-232C) pinout. With a personal computer running ROCLINK 800, you can locally configure the FB107, extract data, and monitor its operation.

Remote configuration is possible from a host computer using a serial communications line. You can duplicate configurations and save them to a disk. In addition to creating a backup, this feature is useful when you are similarly configuring multiple FB107s for the first time, or when you need to make configuration changes off-line. Once you create a backup configuration file, you can load it into an FB107 with the Download function (**File** > **Download**).

Access to the FB107 is restricted to authorized users with correct user ID and password.

You can build custom displays for the FB107 in ROCLINK 800 that combines both graphic and dynamic data elements. The displays can monitor the operation of the FB107 either locally or remotely.

You can archive historical values for any numeric parameter in the FB107. For each parameter configured for historical archiving, the system keeps time-stamped minute, periodic, and daily data values as well as yesterday's and today's daily minimum and maximum values.

You can collect history values from the FB107 using ROCLINK 800 or another third-party host system. You can view history directly from the FB107 or from a previously saved disk file. For each history segment, you can configure the number of periodic history values archived, the frequency of archiving the periodic values, the number of daily values archived, and the contract hour.

ROCLINK 800 can create an EFM (Electronic Flow Measurement) report file that contains all configuration, alarms, events, periodic and

daily history logs, and other history logs associated with the meter runs in the FB107. This file then becomes the custody transfer audit trail.

Use ROCLINK 800 to:

- Configure and view input/output (I/O) points, flow calculations, meter runs, PID control loops, system parameters, and power management features.
- Retrieve, save, and report historical data.
- Retrieve, save, and report events and alarms.
- Perform two-, three-, four-, or five-point calibration on analog inputs and Multi-Variable Sensor (MVS) inputs.
- Perform two-, three-, four-, or five-point calibration on RTD inputs.
- Implement user security.
- Create, save, and edit graphical displays.
- Create, save, edit, and debug Function Sequence Tables (FSTs) of up to 3000 bytes.
- Set up communication parameters.
- Configure Modbus parameters.
- Update the firmware.

#### 1.6 **Product Electronics**

This section describes the FB107 electronic components.

#### 1.6.1 Real-Time Clock

The real-time clock provides the FB107 with the time of day, month, year, and day of the week, as well as real-time stamping of the database values. The real-time clock automatically switches to backup power when the FB107 loses primary input power. Backup power for the real-time clock is adequate for a period in excess of one-year with no power applied to the FB107.

The internal super-cap provides backup for the data and the real-time clock when the main power is not connected. The super-cap has a one-year minimum backup life with the battery installed and no power applied to the FB107.

**Note**: The real-time clock uses the super-cap to keep the current time when you replace the lithium battery.

### 1.6.2 Diagnostic Monitoring

The electronics board has five diagnostic inputs incorporated into the circuitry for monitoring system integrity. Access these analog inputs using the I/O function of ROCLINK 800 software (**Configure** > I/O). Refer to Table 1-1.

System Al		Point of	
Point Number	Function	Origination	Normal Range
E1	Logic voltage	CPU	3.0 to 3.6
E2	Battery voltage	Backplane voltage input connector P1	11.25 to 16 Volts dc 8 to 30 Volts dc
E3	Charge in voltage	CPU power input	0 to 18 Volts dc 8 to 30 Volts dc
E4	System milliAmps	CPU power input	
E5	Board temperature	CPU	-40 to 85°C (-40 to 185°F)

For information on configuring alarms and System AI points, refer to *Chapter 7* in the *ROCLINK 800 Configuration Software User Manual* (for FloBoss 107) (Form A6217).

### 1.6.3 Automatic Self Tests

The FB107 becomes active when input power with the proper polarity and startup voltage (typically set greater than 8.0 volts) is applied to the PWR+/PWR – connector (provided the power input fusing/protection is operational). The battery and logical voltage tests ensure that the FB107 is operating in the optimum mode.

The software arms the watchdog timer every scan period. If the timer is not armed in 6 seconds, the software automatically resets.

#### 1.6.4 Low Power Mode

Under pre-defined conditions, the FB107 uses a sleep mode to conserve power.

During sleep mode, the CPU powers down, although I/O continues to accumulate. The FB107 enters sleep mode after one minute of inactivity on the communication ports. You can disable sleep mode, which ensures that the FB107 stays awake all the time. You configure this option (which is **Disabled** by default) on the Sleep Mode field on the CPU module's **Advanced** tab.

The FB107 wakes from sleep mode occurs when it receives either a:

- Timed interrupt from the real-time clock.
- Signal from one of the communication ports.

#### 1.7 Flow Measurements

Gas and liquid calculation methods include:

- AGA and API Chapter 21 compliant for AGA linear and differential meter types.
- AGA3 Differential for gas.

- AGA7 Pulse (ISO 9951) for gas.
- AGA8 Compressibility for Detailed (ISO 12213-2), Gross I (ISO 12213-3), and Gross II for gas.
- ISO 5167 Differential.

FB107 firmware completes full calculations every second on the configured meter run (up to four) for AGA3, AGA7, AGA8, and ISO 5167.

Note: You must enable meter runs and adjust the number of available meters (ROC > Information > Device Information screen > Points tab, AGAs field) so that additional meter runs become available. You can also optimize a system by disabling unused meters or PIDs.

The primary function of the FB107 is to measure flow in accordance with the 1992 American Petroleum Institute (API), International Standards Organization (ISO), and American Gas Association (AGA) standards.

The primary inputs used for AGA3 flow measurement function are differential pressure, static pressure, and temperature. The differential and static pressure inputs are sampled once per second. The temperature input, which is sampled and linearized once per second, comes from an RTD probe.

AGA3 calculations conform to the methods described in American Gas Association Report No. 3, Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids. Based on the second and third editions, the calculation method is 1992 AGA3.

The primary inputs used for AGA7 flow measurement are pulse input (PI) counts, static pressure, and temperature. The pulse input counts are acquired from a rotary meter, turbine meter, or other pulse-generating devices. the static pressure inputs come from the pressure transducers, and the temperature input is read from an RTD probe.

The AGA7 calculations conform to methods described in American Gas Association Report No. 7, Measurement of Gas by Turbine Meters, and use the AGA8 method for determining the compressibility factor.

The ISO5167-2003 firmware calculates gas flow. Measurement of fluid flow occurs through pressure differential devices inserted in circular cross-section pipes running full.

The AGA8 method calculates the compressibility factor based on the physical chemistry of the component gasses at specified temperatures and pressures.

### **1.8 Additional Information**

Refer to the following documents for additional information:

#### Table 1-2. Additional Information

Name	Form Number	Part Number
ROCLINK 800 Configuration Software User Manual (for FloBoss 107)	A6217	D301249X012
FloBoss 107 Flow Manager and Expansion Rack	5:FB107	D301233X012
FloBoss 107 Firmware	5.2:FW1	D301235X012
FloBoss 107 Inputs and Outputs (I/O)	5.3:IO1	D301236X012
FloBoss 107 Communication Modules	5.3:COM	D301237X012
FloBoss 107 Multi-Variable Sensor (MVS)	5.3:MVS	D301239X012

**Note:** The most current version of these specification sheets is available at www.EmersonProcess.com/Flow.

## Chapter 2 – Installation and Use

This chapter provides generalized guidelines for the successful installation and operation of the FB107.

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### 2.1 Installation Requirements

Planning helps to ensure a smooth installation. Be sure to consider location, ground conditions, climate, and site accessibility, as well as the suitability of the FB107 application while planning an installation.

The versatility of the FB107 allows it to be used in many types of installations. For additional information concerning a specific installation, contact your local sales representative.

### 2.1.1 Environmental Requirements

Ensure the FB107 enclosure provides the level of protection required to keep the units operating under a variety of weather conditions.

The FB107 is designed to operate over a wide range of temperatures. However, in extreme climates it may be necessary to moderate the temperature in which the FB107 must operate. **Note**: In salt spray environments, it is especially important to ensure that the enclosure, including all entry and exit points, is sealed properly.

The FB107 is designed to operate over a -40 to  $75^{\circ}$ C (-40 to  $167^{\circ}$ F) temperature range. When mounting the unit, be aware of external devices that could have an effect on the operating temperature. Operation beyond the recommended temperature range could cause errors and erratic performance. Prolonged operation under extreme conditions could also result in failure of the unit.

The FB107 is designed to function in 90% or less non-condensing humidity.

#### 2.1.2 Site Requirements

Careful consideration in locating the FB107 on the site can help prevent future operational problems. Consider the following when choosing a location:

- Research any restrictions local, state, and federal codes may place on monitoring locations and site requirements. Examples of these restrictions are distance from pipe flanges and hazardous area classifications.
- Locate the FB107 to minimize the length of signal and power wiring.
- Locate antennas for radio and cellular communications with an unobstructed signal path. If possible, locate antennas at the highest point on the site and avoid aiming antennas into storage tanks, buildings, or other tall structures. Allow sufficient overhead clearance to raise the antenna.
- Minimize interference with radio or cellular communications by locating the FB107 away from electrical noise sources, such as engines, large electric motors, and utility line transformers.
- Locate the FB107 away from heavy traffic areas to reduce the risk of being damaged by vehicles. However, provide adequate vehicle access to aid in monitoring and maintenance.
- Consider the physical dimensions of the FB107:
  - Base: 196 mm H by 153 mm W by 134 mm D (7.72 in. H by 6.22 in. W by 5.29 in. D).
  - Base plus expansion rack: 196 mm H by 317 mm W by 134 mm D (7.72 in. H by 12.48 in. W by 5.29 in. D).



Figure 2-1. Side and Front View of FloBoss 107 Base Unit



Figure 2-2. FloBoss 107 and Expansion Rack

## 2.1.3 Compliance with Hazardous Area Standards

The FB107 has approval for Class I Division 2 Groups A, B, C and D. *Class, Division*, and *Group* are defined as:

- Class defines the general nature of the hazardous material in the surrounding atmosphere. Class I is for locations where flammable gases or vapors may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.
- Division defines the probability of hazardous material being present in an ignitable concentration in the surrounding atmosphere. Division 1 locations are presumed to be hazardous. Division 2 locations are areas where gas, dust, or vapors can exist under abnormal conditions.
- **Group** defines the hazardous material in the surrounding atmosphere. Groups A to D are defined as follows:
  - **Group A** Atmosphere containing acetylene, gases or vapors of equivalent hazards.

• **Group B** – Atmosphere containing hydrogen, gases, or vapors of equivalent hazards.

- **Group C** Atmosphere containing ethylene, gases, or vapors of equivalent hazards.
- **Group D** Atmosphere containing propane, gases, or vapors of equivalent hazards.

For the FB107 to be approved for hazardous locations, it must be installed according to the National Electrical Code (NEC) Article 501, and any local code requirements, if applicable.

Caution When installing units in a hazardous area, make sure all installation components selected are labeled for use in such areas. Installation and maintenance must be performed only when the area is known to be non-hazardous. Installation in a hazardous area could result in personal injury or property damage.

### 2.2 **Power Installation Requirements**

Typical sources of primary power for FB107 installations are dc voltage sources and solar power. Take care to route power away from hazardous areas, sensitive monitoring devices, and radio equipment. Local and company codes generally provide guidelines for power installations. Adhere rigorously to all local and National Electrical Code (NEC) requirements for power installations.

The FB107 accepts input voltages from 8.0 volts to 30 volts at the PWR (IN+/IN-) terminals on the CPU. The CPU terminal block accepts wires from size 16 to 24 AWG.

The AUX PWR IN terminal block accepts wires from size 12 to 22 AWG.

**Note:** For a fully loaded eight-slot FB107, the maximum power for a dc voltage source **should not exceed 22 watts**.

#### 2.3 Grounding Installation Requirements

Grounding wiring requirements for dc voltage sources equipment are governed by the National Electrical Code (NEC). When the equipment uses dc voltage sources, the grounding system must terminate at the service disconnect. All equipment grounding conductors must provide an uninterrupted electrical path to the service disconnect.

 The National Electrical Code Article 250-83 (1993), paragraph c, defines the material and installation requirements for grounding electrodes.

- The National Electrical Code Article 250-91 (1993), paragraph a, defines the material requirements for grounding electrode conductors.
- The National Electrical Code Article 250-92 (1993), paragraph a, provides installation requirements for grounding electrode conductors.
- The National Electrical Code Article 250-95 (1993) defines the size requirements for equipment grounding conductors.

Proper grounding of the FB107 helps to reduce the effects of electrical noise on the unit's operation and protects against lightning. The FB107 provides lightning protection for built-in field wiring inputs and outputs. Install a surge protection device at the service disconnect on dc voltage source systems to protect against lightning and power surges for the installed equipment.

All earth grounds must have an earth-to-ground rod or grid impedance of 25 ohms or less as measured with a ground system tester. The grounding conductor should have a resistance of 1 ohm or less between the FB107 enclosure ground and the earth ground rod or grid.

The recommended cable for I/O signal wiring is an insulated, shielded, twisted-pair. The twisted pair and the shielding minimize signal errors caused by EMI (electromagnetic interference), RFI (radio frequency interference), and transients.

## 2.3.1 Installing Grounding for the FloBoss 107

If your company has no specific grounding requirements, install the FB107 as a floating system (unconnected to ground). Otherwise, follow your company's specific grounding practices. However, if you are making a connection between a grounded device and the FB107's EIA-232 (RS-232) port, ground the FB107's power input by connecting the PWR– to ground.

The grounding installation method for the FB107 depends on whether the pipeline has cathodic protection. On pipelines with cathodic protection, the FB107 must be electrically isolated from the pipeline.

Electrical isolation can be accomplished by using insulating flanges upstream and downstream on the meter run. In this case, you can place the FB107 in an enclosure which is either flange-mounted or saddle-clamp mounted directly on the meter run and grounded with a ground rod or grid system.

On pipelines without cathodic protection, the pipeline itself may provide an adequate earth ground and the FB107 can be placed in an enclosure and could mount directly on the meter run. Test with a ground system tester to make sure the pipeline to earth impedance is less than 2 ohms. If the pipeline provides an adequate ground, you may not need to install
a separate ground rod or grid system. All grounding should terminate at a single point.

If the pipeline to earth impedance is greater than 2 ohms, electrically isolate the FB107 installation and install a ground rod or grid grounding system.

#### 2.3.2 I/O Wiring Requirements

I/O wiring requirements are site- and application-dependent. Local, state, and NEC requirements determine the I/O wiring installation methods. Direct buried cable, conduit and cable, or overhead cable are all options for I/O wiring installations.

Shielded, twisted-pair cable is recommended for I/O signal wiring. The twisted-pair minimizes signal errors caused by Electro-Magnetic Interference (EMI), Radio Frequency Interference (RFI), and transients. Use insulated, shielded, twisted-pair wiring when using MVS signal lines. The terminal block accepts wires up to size 16 to 24 AWG.

## 2.4 Installing the FloBoss 107 and Expansion Rack

This section details how to install the FB107 base unit and the expansion rack.

Caution To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions (such as wearing a grounded wrist strap).

When working on units located in a hazardous area (where explosive gases may be present), make sure the area is in a non-hazardous state before performing procedures. Performing these procedures in a hazardous area could result in personal injury or property damage.

## 2.4.1 Required Tools

Use the following tools to perform installation and maintenance procedures on the FB107. For tools required for installation or maintenance of accessories, refer to the *ROC/FloBoss Accessories Instruction Manual* (Form A4637).

- Philips screwdriver, size 0.
- Flat blade screwdriver, size 2.5 mm (0.1 inch).
- Flat blade screwdriver, large.

#### 2.4.2 Installing the FloBoss 107 without an Expansion Rack

To install the FB107 base unit without the expansion rack:

- 1. Using the four holes on the FB107 base unit, mark the points at which the base unit should attach to the wall (refer to *Figure 2-1*).
- **2.** Drill four holes into the wall.
- **3.** Position the FB107 to line up with the mounting holes you drilled.
- **4.** Insert the screws through the FB107 base unit and screw them into the wall or the mounting plate. **Do not** over tighten.

**Note:** Depending on your installation, you may require wall anchors or longer screws than are supplied.

**Using an** Adapter Plate To simplify installation, you can purchase an optional metal adapter plate (product number FS1-ADP1) for the FB107 base unit (see *Figure* 2-3. Adapter Plate (FB107 Base Unit). After you secure the adapter plate to its location, the FB107 base unit attaches directly to the adapter plate.



Figure 2-3. Adapter Plate (FB107 Base Unit)

To install the FB107 base unit to the FS1-ADP1 adapter plate:

- **1.** Place the base unit over the attachment posts.
- **2.** Secure the base unit to the adapter plate using the four provided plate screws. Torque screws to 10-12 in/lbs.

#### 2.4.3 Installing the FloBoss with an Expansion Rack

The expansion rack has connectors for the I/O, MVS, and smart application modules.

Do not remove the backplane from the housing. The backplane does not contain any field-serviceable parts. If the backplane requires maintenance, please contact your local sales representative.

#### Notes:

- The alignment of the connectors between the base unit and expansion rack is critical.
- The optional adapter plate (product FS1-ADP2) greatly simplifies the installation process for an expansion rack.

To install the FB107 with the expansion rack:

- **1.** Remove power from the FB107.
- **2.** Align and gently press together the left edge of the expansion rack with the right edge of the base unit. Ensure that the connectors fit together.
- **3.** Using the four holes on the expansion rack, mark the points at which the expansion rack should attach to the wall. Refer to *Figure 2-2*.
- 4. Detach the expansion rack from the base unit.
- **5.** Drill four holes into the wall.
- **6.** Reattach the expansion rack to the base unit, ensuring that the holes in the expansion rack align with the mounting holes you drilled.
- **7.** Insert the screws through the expansion rack into the wall. **Do not** over tighten.
- **8.** Return power to the FB107.

Note: Depending on your installation, you may require wall anchors or	
longer screws than are supplied.	

# **Using an** Adapter Plate To simplify installation, you can purchase an optional metal adapter plate (product number FS1-ADP2) for the FB107 base unit and expansion rack. After you secure the adapter plate to its location, the base unit and expansion rack attach directly to the adapter plate.



Figure 2-4. Adapter Plate (FB107 Expansion Rack)

To install the base unit and expansion rack to the FS1-ADP2 adapter plate:

- **1.** Place the unpowered FB107 base unit on the left side of the adapter plate so that the attachment posts touch the right-most inside of the plastic housing.
- 2. Slide the base unit to the right.

**Note:** You should feel the retaining clips attach to the back of the base unit and the attachment posts should appear in the rightmost holes on the base unit's plastic housing.

- **3.** Secure the base unit to the adapter plate by placing two plate screws in the upper and lower right-most holes in the base unit. Torque screws to 10-12 in/lbs.
- **4.** Place the expansion rack on the right side of the adapter plate so that the attachment posts touch the left-most inside of the plastic housing. The connector on the expansion rack should be adjacent to, but not touching, the connector on the base unit.
- **5.** Slide the expansion rack to the left until the connectors seat firmly together.
  - **Note:** You should feel the retaining clips attach to the back of the expansion rack and the attachment posts should appear in the left-most holes on the expansion rack's plastic housing.
- **6.** Secure the expansion rack to the adapter plate by attaching two plate screws in the upper and lower left-most holes in the expansion rack. Torque screws to 10-12 in/lbs.

7. Secure the adapter plate to the wall using four 1 inch screws.

**Note**: Adding an expansion rack and the modules may require you to adjust your FB107 power consumption requirements. Refer to *Chapter 3, Determining Power Consumption.* 

#### 2.4.4 Removing an Expansion Rack

**Note**: Before you remove an expansion rack, you must power down the FB107 and disconnect **all** wiring from **all** modules.

To remove an expansion rack from an existing FB107 base unit:

- **1.** Remove power from the FB107.
- 2. Disconnect all wiring from all modules
- **3.** Unscrew the four screws that secure the expansion rack to the wall.

**Note**: If you are using an optional adapter plate, remove the four retaining plate screws.

**4.** Gently slide the expansion rack to the right away from the FB107 base unit.

**Note**: The expansion rack detaches quickly. Hold it securely to prevent it from falling.

**5.** Restore power to the FB107.

#### 2.4.5 Removing and Installing Module Slot Covers

Before you insert an I/O, MVS, Smart application, or communications module, you must remove the cover over the empty module slots in which you intend to install the modules.

Caution To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions (such as wearing a grounded wrist strap).

When working on units located in a hazardous area (where explosive gases may be present), make sure the area is in a non-hazardous state before performing procedures. Performing these procedures in a hazardous area could result in personal injury or property damage.

#### To remove a module slot cover:

- 1. Press the tab on the right side of the slot cover in.
- **2.** Lift up and remove the slot cover.

**Note**: If you remove a module for an extended period, install a slot cover over the empty module slot to prevent dust and other matter from getting into the FB107.

#### To install a module slot cover:

- 1. Place the slot cover over the empty slot. The tabs on the left side of the slot cover help align the cover in the empty slot.
- **2.** Lower the slot cover until it clicks in place.

#### 2.4.6 Removing and Installing Wire Channel Covers

Install the wire channel covers over the wiring channels once the wiring of the terminal blocks is complete. Wire channel covers are located on the front of the FB107.

#### To remove a wire channel cover:

- **1.** Grasp the wire channel cover at either the right or left edge.
- **2.** Firmly pull the cover up from the wire channel.

#### To replace a wire channel cover:

- **1.** Align the wire channel cover over the wire channel, ensuring unobstructed wire access.
- 2. Press the wire channel cover down into place until it snaps.

#### 2.5 Memory Backup Battery

A super capacitor ("super-cap") and a coin type battery work together to provide backup power for the static RAM and the real-time clock. This helps to ensure retention of short and longer-term data, configuration, and operational integrity when the FB107 is not in service or is in storage.

**Note**: You can replace the battery with a standard coin type lithium model CR2032 (DL2032).

# Caution To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions (such as wearing a grounded wrist strap).

When working on units located in a hazardous area (where explosive gases may be present), make sure the area is in a non-hazardous state before performing procedures. Performing these procedures in a hazardous area could result in personal injury or property damage.

#### 2.5.1 Removing and Installing the Battery

To remove the battery on the backplane:

**1.** Remove power from the FB107.



Figure 2-5. Memory Backup Cap

- **2.** Slide the Memory Backup cover to the left.
- **3.** Remove the battery by gently prying the battery from its terminals.
- **4.** Replace the battery by placing the battery positive-side up and gently pressing it into place.
- 5. Slide the Memory Backup cover back over the battery.
- **6.** Restore power to the FB107.

Note: The super-cap is not field-replaceable.

#### 2.6 Central Processor Unit (CPU)

The FB107 base unit has four slots. Slot 0 is reserved for the CPU module. The CPU provides connections to the field wiring and surge and static discharge protection for the field wiring. Electronics include the RTD, comms, and power.

The CPU contains the firmware, the three built-in communication ports and LEDs, a reset (RST) switch, RTD input, and a power LED indicating system integrity.

The internal super-cap backup battery provides backup of data and the real-time clock when the main power is not connected.



Figure 2-6. CPU Module

## 2.6.1 Removing the CPU Module

▲ Caution
Failure to exercise proper electrostatic discharge precautions (such as wearing a grounded wrist strap) may reset the processor or damage electronic components, resulting in interrupted operations.
When working on units located in a hazardous area (where explosive gases may be present), make sure the area is in a non-hazardous state before performing procedures. Performing these procedures in a hazardous area could result in personal injury or property damage.
To remove the CPU module:
1. Perform the backup procedure described in *Preserving Configuration and Log Data* in *Chapter 7*, *Troubleshooting*.

**2.** Remove power from the FB107.

- **3.** Remove all wiring from the CPU.
- **4.** Place your fingers on the ridged edges on both sides of the CPU module and pull gently (see Figure 2-7). The cover should slide forward and stop, releasing the module lock.



Figure 2-7. Ridged Edges on CPU Module

**5.** Gently rock the module until it releases from the backplane and you can remove it from the base unit.

#### 2.6.2 Installing the CPU Module

Failure to exercise proper electrostatic discharge precautions (such as wearing a grounded wrist strap) may reset the processor or damage electronic components, resulting in interrupted operations. When working on units located in a hazardous area (where explosive gases may be present), make sure the area is in a non-hazardous state before performing procedures. Performing these procedures in a hazardous area could result in personal injury or property damage. To install the CPU module: **1.** Remove power from the FB107. **2.** Slide the CPU module into slot 0. **Note:** The CPU wire terminals face to the left. A tab on the module case prevents you from installing the module incorrectly. **3.** Press the CPU firmly into the slot. The connectors at the back of the CPU module fit securely into the connectors on the backplane. **4.** Wire the CPU.

- **5.** Review *Restarting and Reconfiguring the FB107* in *Chapter 7*, *Troubleshooting*.
- **6.** Return power to the FB107.

#### 2.7 License Keys

License keys with valid license codes grant access to applications or allow optional firmware functionality to execute. A license key may also be required before you can run the application. Examples of licensed applications may include flow or properties calculations and various user programs. You can configure these applications using ROCLINK 800's License Key Administrator function (**Utilities** > **License Key Administrator**).

If you remove a license key after enabling an application, the firmware disables the task from running. This prevents unauthorized execution of protected applications.

**Note:** You must remove power and re-power the FB107 when you install or remove a license key.

#### 2.8 Startup and Operation

Before starting the FB107, perform the following checks to ensure the unit is properly installed.

- Check the field wiring for proper installation.
- Make sure the input power has the correct polarity.
- Make sure that the CPU, I/O, MVS, smart application, and communication modules are seated in the backplane.
- Make sure the input power is fused at the power source. Plug the input power either into the AUX PWR IN on the base unit or into the connector labeled PWR+ / PWR on the CPU module.

#### 2.8.1 Startup

Before you apply power to the FB107, assess the power requirements (including the base unit, expansion rack, and any installed modules and peripheral devices) that comprise the total configuration for your FB107. Refer to *Determining Power Consumption* in *Chapter 3, Power Connections*.

Apply power to the FB107. The power input PWR+ LED indicator should light green to indicate that the applied voltage is correct and a valid operation is active.

After the start-up diagnostics (RAM and other internal checks) complete, you should be able to log in to the FB107, which indicates the

FB107 completed a valid reset sequence. If you cannot log on to the FB107, refer to *Chapter 7, Troubleshooting*, for possible causes.

**Caution** Check the input power polarity before connecting power to the FB107. Incorrect polarity can damage the FB107.

When working on units located in a hazardous area (where explosive gases may be present), make sure the area is in a non-hazardous state before performing procedures. Performing these procedures in a hazardous area could result in personal injury or property damage.

#### 2.8.2 Operation

Once startup is successful, it is necessary to configure the FB107 to meet the requirements of the application. Refer to the *ROCLINK 800 Configuration Software User Manual (for FloBoss 107)* (Form A6217) for procedures on configuring the FB107 and calibrating its I/O. Once you configure and calibrate the FB107, you can place it in operation.

During operation, you can monitor the FB107 to view or retrieve current and historical data either locally or remotely. You accomplish local monitoring by using ROCLINK 800 on a PC connected through the LOI port. You accomplish remote monitoring by using ROCLINK 800 connected through the COM1 through COM3 ports.

The FB107 has a number of software settings (parameters) which you must configure before the unit is calibrated and placed into operation. You configure the FB107 using ROCLINK 800, which runs on an IBM-compatible PC. Normally, the PC is connected to the LOI port of the FB107 to transfer configuration data into the FB107, although much of the configuration can be performed off-line and later loaded into the unit.

The FB107 firmware provides default values for all parameters. If the default values are acceptable for your application, leave the device as it was delivered from the factory.

# **Chapter 3 – Power Connections**

This chapter describes wiring power from a dc voltage source.

In This Chapter

3.1	Power Input Descriptions	3-1
3.2	Determining Power Consumption	3-3
3.3	Wiring Connections	3-8
3.4	Wiring Power to the CPU Module	3-9

#### 3.1 **Power Input Descriptions**

The FB107's power terminals (either through the AUX PWR IN connection on the base unit or through the power connections on the CPU module) convert external input power to the voltage levels the FB107's electronics require.



Figure 3-1. FB107 Power Inputs

Caution When installing units in a hazardous area, make sure all installation components selected are labeled for use in such areas. Installation and maintenance must be performed only when the area is known to be non-hazardous. Installation in a hazardous area could result in personal injury or property damage.

Take care to route power away from hazardous areas, sensitive monitoring devices, and radio equipment. Local and company codes generally provide guidelines for power installations. Adhere rigorously to all local and National Electrical Code (NEC) requirements for power installations.

**Power** Requirements A dc voltage source is the typical source of primary power for FB107 installations. The FB107 accepts input voltages from 8.0 volts to 30 volts either at the AUX PWR IN connection on the base unit or at the PWR (IN+ / IN–) terminals on the CPU. The AUX PWR IN terminal block accepts wires from size 12 to 22 AWG.

**Note:** For a fully loaded eight-slot FB107, the maximum power for a dc voltage source **should not exceed 22 watts**.

The power consumption of an FB107 and the attached expansion racks determines the current requirements for the external power supply.

The CPU module's power input has a removable terminal block for wiring and servicing. The terminal blocks can accept size 16 to 24 AWG (American Wire Gauge).

Note: Isolation occurs between the CPU and the field logic.

Using ROCLINK 800, you can configure the I/O on the CPU module to set the loop output power to 10 volts dc or 24 volts dc using ROCLINK 800. The I/O module only supports 24 volts dc loop output power.

**Note:** The CPU I/O assembly uses the CPU's loop power output and ground connections.

The intent of the loop output power is to power devices that require 24 volts dc to ground, allowing the external device to send the FB107 a 4 to 20 mA signal based on pressure, temperature, level, and such.

The 10-volt loop output power is intended for low power transmitters. The loop current is designed to deliver 80 mA to power two field devices that connect back to the two analog inputs.

**Note**: If the input voltage is greater than the 10-volt loop, then the loop voltage equals the input voltage. For example, if the PWR IN is 14 volts dc and you select a 10-volt loop, the loop output equals 14 volts dc.

You can use current analog inputs of 4 to 20 mA when the 250-ohm resistor is selected in the AI configuration using ROCLINK 800.

Terminal Blocks	Definition	Volts DC
PWR (IN + / IN –)	Accepts up to 28 Volts dc nominal from an AC/DC converter or other 28 volts dc supply.	8 to 30 Volts dc
LOOP and GND	Supplies 10 Volts dc or 24 Volts dc source voltage to external field devices. Current limit protected.	10 Volts dc or 24 Volts dc

Table 3-1. Input Terminal Block Connections

#### 3.2 Determining Power Consumption

Use *Tables 3-2* and *3-3* to identify and assess the power requirements for each component of your system. If the power input is not sufficient, you require an alternative power supply for external device or you need to lessen power demands.

To determine the power consumption requirements for an FB107 configuration, complete the following steps:

- 1. Determine your ideal FB107 configuration, which includes identifying all modules, device relays, meters, solenoids, radios, transmitters, and other devices that may receive dc power from the complete FB107 configuration (base unit and expansion rack).
- **2.** Calculate the "worst-case" dc power consumption for that configuration by totaling the combined power draw required for all installed modules, as well as accounting for the power any modules provide to external devices, through the use of LOOP.

Note: The "Line #s" correspond with the Line value in *Table 3-2*.

- **3.** Line 1 Select your normalized input voltage as 12 or 24 volts dc in *Table 3-2*.
- **4.** Line 2 Determine the kind of CPU module you are using in *Table 3-2*. Calc Power (mW) equals:
  - Non-isolated FB107 = **360**
  - Isolated FB107 = **540**
- **5.** Line 3 Select if you are using a CPU I/O Assembly in *Table 3-2*. Calc Power (mW) equals:
  - No CPU I/O Assembly =  $\mathbf{0}$
  - CPU I/O Assembly used = **36**
- 6. Line 4 Determine how many I/O modules you are using in *Table 3-2*. Calc Power (mW) equals:
  - No I/O modules =  $\mathbf{0}$
  - One I/O module = **180**
  - Two I/O modules = 360
  - Three I/O modules = **540**
  - Four I/O modules = **720**
  - Five I/O modules = **900**
  - Six I/O modules = **1080**

- **7.** Line 5 Select if you are using a EIA-232 (RS-232) communications module in *Table 3-2*. Calc Power (mW) equals:
  - No EIA-232 (RS-232) communications module = 0
  - One EIA-232 (RS-232) communications module used = **36**
- 8. Line 6 Select if you are using a EIA-485 (RS-485) communications module in *Table 3-2*. Calc Power (mW) equals:
  - No EIA-232 (RS-232) communications module = 0
  - One EIA-232 (RS-232) communications module used = **36**
- **9.** Line 7 Indicate whether you are using an MVS module in *Table 3*-2.
- **10.** Line 8 Select if you are using Remote MVS transmitter in *Table 3-2*. Calc Power (mW) equals:
  - No Remote MVS transmitter = 0
  - One Remote MVS transmitter = **180**
  - Two Remote MVS transmitters = **360**
  - Three Remote MVS transmitters = **540**
  - Four Remote MVS transmitters = **720**
- **11.** Line 9 Select if you are using a DVS in *Table 3-2*. Calc Power (mW) equals:
  - No DVS used =  $\mathbf{0}$
  - One DVS used = 12
- **12.** Line 10 Total Lines 2 through 9 in the Calc Power (mW) column of *Table 3-2*.
- **13.** Line 11 Convert the Total Calc Power (mW) to Watts:
  - Watts = mW ÷ 1000
- **14.** Line 12 Determine field side power requirements in Watts. Refer to *Table 3-3*.
- **15.** Line 13 Add the FloBoss Total in (Watts) total from *Table 3-2* to the field side total from Table 3-3 (Watts) to determine the overall power requirements (Total Estimated Power Consumption).

Line 14 equals Total FloBoss and Field Side Power Requirements (Watts).

- **16.** Line 14 Calculate current draw on power systems:
  - Amps = Total Power divided by Input Voltage

Line		Nominal					
1	System Power Input	12 or 24	Volts dc				
			Quantity	Input Voltage (Volts dc)	Nominal Current (mA)	Duty Cycle	Calc Power (mW)
2	Base Unit including	Non-Isolated	0 or 1	12	30	100%	360 or 540
4	CPU and Backplane	Isolated	0 or 1	12	45	100%	500 01 540
	Expansion Rack	—	_	-	0	100%	
3	Innute/Outpute	CPU I/O Assembly	0 or 1	12	3	100%	
4	mputs/Outputs	I/O Modules	0 to 6	12	15	100%	
5		RS-232	0 or 1	12	3	100%	
6		RS-485	0 or 1	12	3	100%	
7	MVS Module	MVS	0 or 1	12	10	100%	
8	MVS Transmitters	Remote MVS	0, 1, 2, 3, or 4	12	15	100%	
9		DVS	0 or 1	12	1	100%	
10	0 mW (Totals of Lines 2 through 9)						
11	1 FloBoss Total in Watts (Line 10 ÷ 1000)						
12		Total Field Side	Power Co	onsumption f	rom Table 3	-3 (Watts)	
13	Total FloBoss	and Field Side Powe	r Require	ments in Wa	tts (Line 12	+ Line 13)	
14		Total	System	Current dra	w on Powe	er Source	

Table	3-2.	Estimated	Power	Consump	tion
-------	------	-----------	-------	---------	------

Entered Values =

Calculated Values =

Calculated Power (mW) = Quantity \* (V dc \* mA) \* Duty Cycle

Note: Base Unit = CPU, backplane, on-board communications, LEDs, and RTD input Amps = Total Power divided by Input Voltage (Line 14)

Field Side		Quantity	Input Voltage (Volts dc)	Nominal Current (mA)	Duty Cycle	Calc Power (mW)	
Field Transmitters	Current Loops		24	20			
Communications							
Radio	RX						
	Stand-By						
	ТХ						
Display							
Additional Equipment							
							mW
				Watts = mW	÷ 1000		Watts

Table 3-3. Field Side Power Consumption

The **Field Side** includes all other equipment connected and drawing power from the FB107.

Line		Nominal					
1	System Power Input	24	Volts dc				
			Quantity	Input Voltage (Volts dc)	Nominal Current (mA)	Duty Cycle	Calc Power (mW)
2	Base Unit including	Non-Isolated	1	12	30	100%	360
2	CPU and Backplane	Isolated	0	12	45	100%	300
	Expansion Rack	—	_	_	0	100%	0
3	Innute/Outnute	CPU I/O Assembly	1	12	3	100%	36
4	inputs/Outputs	I/O Modules	2	12	15	100%	360
5		RS-232	1	12	3	100%	36
6		RS-485	0	12	3	100%	0
7	MVS Module	MVS	0	12	10	100%	0
8	MVS Transmitters	Remote MVS	0	12	15	100%	0
9		DVS	0	12	1	100%	0
10				mW (Totals	of Lines 2 th	rough 9)	792.00
11	1 FloBoss Total in Watts (Line 10 ÷ 1000)					0.80	
12	2 Total Field Side Power Consumption from (Watts)					1.35	
13	Total FloBoss	and Field Side Powe	r Require	ments in Wa	tts (Line 12	+ Line 13)	2.15
14		Total	System	Current dra	w on Powe	r Source	2.14

Table	3-4.	Power	Consump	otion	Exam	ple
-------	------	-------	---------	-------	------	-----

Field Side		Quantity	Input Voltage (Volts dc)	Nominal Current (mA)	Duty Cycle	Calc Power (mW)
Field Transmitters	Current Loops	2	24	20	60%	576
	DO	1	12	2	30%	7.2
Communications						
Radio	RX	1	12	3	15%	5.4
	Stand-By	1	12	0.5	80%	4.8
	ТХ	1	12	250	5%	150
Display		0	12		100%	0
Additional Equipment		1	12	50	100%	600
					mW	1343.4
					Watts	1.3434

#### 3.3 Wiring Connections

This section describes how to connect the FB107 to power, I/O devices, and communications devices. Use the recommendations and procedures described in this section to avoid damage to equipment.

Note: Check the input power polarity before you apply the power.

The external connections or field terminals are located on the CPU or optional modules. The terminal block accepts wires up to size 16 to 24 AWG.

Always turn off the power to the FB107 before you attempt any type of wiring. Wiring of powered equipment could result in personal injury or property damage.

To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.

I/O wiring requirements are site and application dependent. Local, state, or NEC requirements determine the I/O wiring installation methods. Direct burial cable, conduit and cable, or overhead cables are options for I/O wiring installations.

# **Caution** Failure to exercise proper electrostatic discharge precautions, such as wearing a grounded wrist strap may reset the processor or damage electronic components, resulting in interrupted operations.

To connect the wire to the removable block compression terminals:

- 1. Strip  $\frac{1}{4}$  inch of insulation from the wire.
- 2. Insert the bare end into the clamp beneath the termination screw.
- 3. Tighten the screw, taking care not to over-torque it.

Expose a minimum of bare wire to prevent short circuits. Allow some slack when making connections to prevent strain.

Note: Twisted-pair cable is recommended for I/O signal wiring.

#### 3.4 Wiring Power to the CPU Module

Typically, you would use the AUX PWR IN connection on the FB107 base unit to power the FB107. Alternately, you can wire power directly into the CPU module.



Figure 3-2. Power Wiring, CPU Module

The CPU module connectors use compression terminals. The input power termination (IN+ / IN–) uses a removable connector and accommodates wiring size 16 to 24 AWG. Refer to *Section 3.3, Wiring Connections*.

The FB107 accepts input voltages from 8.0 volts to 30 volts at the PWR IN+ / IN- input power terminals

The terminals are labeled IN+ for positive power connection (8.0 to 30 volts power) and IN– for negative power connection (Battery Common) on a label on the CPU. Refer to *Figure 3-2*.

**Note:** Follow good wiring practices when sizing, routing, and connecting power wiring. All wiring must conform to state, local, and NEC codes.

# Chapter 4 – Inputs/Outputs and RTD Inputs

This chapter describes the input/output (I/O) termination points available on the CPU module's optional I/O assembly and on the I/O modules. I/O points provide additional inputs and outputs for implementing expanded monitoring and control applications. This chapter also describes the resistance thermal device (RTD) input on the CPU.

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#### 4.1 I/O Description

The I/O options use the microprocessor for monitoring, control, and acquisition of data from external devices connected to the I/O channels. The I/O channels have a removable plug-in terminal block for field wiring. You can order the expanded 6-point I/O as an:

- I/O assembly that mounts directly on the CPU module.
- I/O modules that mount in the I/O slots.

Both ways provide configuration terminations for six points of expansion I/O and both provide the same selections for I/O.

The six points of I/O consist of:

- Two analog inputs (AI) or discrete inputs (DI).
- One analog output (AO) or discrete output (DO).
- One discrete output (DO).
- Two pulse inputs (PI) or discrete inputs (DI).

Using ROCLINK 800, you can select and configure five of the six points of I/O. Use ROCLINK 800 to select the inputs and outputs on the I/O Setup screen.

You can add an expansion rack to the FB107 to increase I/O by four slots for a total of six slots of I/O. The FB107 can support up to 42 points of I/O.

You can install I/O modules in slots 1 through 3 on the FB107 base unit and in slots 4 through 6 on the expansion rack. When you install a non-I/O module in slot 1, you can install an I/O module in slot 7 of the expansion rack. The FB107 supports up to six I/O modules and one CPU I/O assembly.

I/O support for the FB107 includes:

- Analog inputs (AI) that provide the ability to monitor various analog field values.
- Discrete inputs (DI) and pulse inputs (PI) that provide the ability to monitor various discrete and pulse input field values.
- Analog outputs (AO) and discrete outputs (DO) that provide the ability to manage various control devices.
- RTD input provides the ability to monitor various analog temperature field values.

Each module rests in a module slot at the front of the FB107 base unit or expansion rack. The CPU I/O assembly attaches to the CPU module.

The I/O modules acquire power from the backplane. Each module has a dc/dc converter that provides logic, control, and field power as required. The CPU I/O assembly acquires logic, control, and field power from the CPU module.

The FB107 has eliminated the need for fuses on the loop output and analog output through the extensive use of current-limited short-circuit protection.

*Figure 4-1* and *Table 4-1* detail the I/O terminations on the I/O module. *Figure 4-2* and *Table 4-2* detail the I/O terminations on the CPU module's optional I/O assembly.

Note: There are slight differences in the termination positions.



Figure 4-1. I/O Module

Table 4	-1. I/O	<b>Terminations</b>	on the I/O	Modules
---------	---------	---------------------	------------	---------

Termination Number	on I/O Type		
13	Loop Output Power		
12	AI1+/DI1+		
11	GND – (Common)		
10	AI2+/DI2+		
9	AO+/DO1+		
8	AO-/DO1-		
7	DO2+		
6	DO2-		
5	PI1+/DI3+		
4	GND – (Common)		
3	PI2+/DI4+		
2	NC (No Connection)		
1	GND – (Common)		



Figure 4-2. CPU Module's Optional I/O Assembly

Table	4-2. I/O	<b>Terminations</b>	on the C	CPU Modu	le's O	otional I/O	Assembly
Indic	1 2.1/0	1 CI III III III IIII		I O moun			rissemery

Termination Number	І/О Туре			
10	AI1+/DI1+			
9	GND – (Common) Al2+/Dl2+ AO+/DO1+ AO-/DO1– DO2+			
8	AI2+/DI2+			
7	AO+/DO1+			
6	AO-/DO1-			
5	DO2+			
4	DO2-			
3	PI1+/DI3+			
2	GND – (Common)			
1	PI2+/DI4+			

#### 4.2 Installing a Module

All FB107 modules for the FB107 are designed for ease of installation and removal. They contain no user-serviceable components.

**Note:** A tab on the module case prevents you from installing the module incorrectly.

To install an I/O module in either the base unit or the expansion rack:

- **1.** Remove power from the FB107.
- **2.** Remove the wire channel cover.
- **3.** Perform one of the following:
  - If there is a module currently in the slot, remove that module. Refer to *Section 4.3, Removing a Module.*
  - If the slot is currently empty, remove the slot cover.
- **4.** Insert the module in the slot on the base unit or expansion rack. Ensure that the module is installed facing the correct direction. Gently slide the module into place until it contacts properly with the connectors on the backplane.

Note: If the module stops and does not go any further, **do not** force the module. Remove the module and see if the pins are bent. If the pins are bent, gently straighten the pins and re-insert the module. The back of the module **must** connect fully with the connectors on the backplane.

- 5. Wire the I/O module. Refer to Section 4.4, Wiring I/O.
- **6.** Replace the wire channel cover.

Caution Never connect the sheath surrounding shielded wiring to a signal ground terminal or to the common terminal of an I/O module or CPU I/O assembly. Doing so makes the I/O module susceptible to static discharge, which can permanently damage the I/O. Connect the shielded wiring sheath only to a suitable earth ground.

- 7. Return power to the FB107.
- **8.** Connect to ROCLINK 800 and log in.
- **9.** Configure the I/O point.

**Note**: You must perform a power re-start to enable the ROCLINK 800 software to identify the module.

#### 4.3 Removing a Module

To remove an I/O module:

- 1. Remove power from the FB107.
- **2.** Remove the wiring (or the removable terminal blocks) from the module.
- **3.** Place your fingers on the ridged edges on both sides of the module and pull out gently (see *Figure 4-3*). The cover should slide forward and stop, releasing the module lock.



Figure 4-3. Ridged Edges on Modules

**4.** Gently rock the module until it releases from the backplane and you can remove it from the base unit or expansion rack.

#### 4.4 Wiring a Module

I/O wiring requirements are site and application dependent. Local, state, or NEC requirements determine the I/O wiring installation methods. Direct burial cable, conduit and cable, or overhead cables are options for I/O wiring installations.

All I/O modules, the CPU I/O assembly, and RTD inputs have terminal blocks for convenient wiring and servicing. The terminal blocks accommodate size 16 to 24 AWG.

Caution Failure to exercise proper electrostatic discharge precautions, such as wearing a grounded wrist strap may reset the processor or damage electronic components, resulting in interrupted operations.

To connect the wire to the removable block compression terminals:

- **1.** Strip  $\frac{1}{4}$  inch of insulation from the wire.
- **2.** Insert the bare end into the clamp beneath the termination screw.
- **3.** Tighten the screw, taking care not to over-torque it.

Expose a minimum of bare wire to prevent short circuits. Allow some slack when making connections to prevent strain.

Note: Twisted-pair cable is recommended for I/O signal wiring.

#### 4.5 Selecting the Type of I/O

Using ROCLINK 800, you select the type of input or output.

1. Log on to the FB107 using ROCLINK 800.

**Note**: ROCLINK 800 provides an enhanced graphical user interface (GUI) for the FB107. This interface displays an image of the FB107 above a tabbed screen (see *Figures 4-4* and *4-5*). You select the FB107 module and then use the tabbed screen to configure the components.

**2.** Click the **I/O module**. The display immediately under the FB107 image changes to reflect your selection.

**Note**: *Figure 4-5* shows the default values for an I/O module.

BOCLINK 800 - [On Line - Com1 - FB107]		
File Edit View ROC Configure Meter Utilitie	ies <u>T</u> ools <u>W</u> indow <u>H</u> elp	- 8 ×
D 😅 🖬   X 🖬 🛍 👍 의 🍡 🔍 🍳	🛯 🗸 🎹 🐜   K- III-   🛱 ≉ 📀 🗳 🕍 🔛 💕   🖓 📝	
Con Line - Com1 - FB107  Con Line - Com1 - FB107  Control - FB107  Control - Support - Not Installed  Control - Support - Not Installed  Control - Support - Not Installed  Module Information  Module Infor		
⊞	Installed Module : Auxiliary 6-Point IO Actual Module : Auxiliary 6-Point IO	
	Description : Auxiliary IO Module Revision : Rev. 1.00	
	Part Number : W68186 Build Date : Dec 12, 2006, 13:29	
	Serial Number : Boot Revision : Rev. 0.10a	
	Boot Build Date : Oct 11, 2006, 5:52	
	Integrity : ]	
	SLOT 4 - Auxiliary 6-Point ID Auto Scan Dupdate	
	ON-LINE 3:	02 PM

Figure 4-4. FloBoss 107 ROCLINK 800 User Interface

**3.** Click the **I/O Setup** tab.

	General 1/0	Setup   1/0 Poin	its					
	-1/0 Туре		1 - 250 Ok	im Resistor	Installed-			
	Al-1	O DI-1	Al-1	Yes	⊂ No			
	Al-2	O DI-2	AI-2	( Yes	C No			
	A0-1	O DO-1		μς				
	PI-1	C DI-3						
	PI-2	C DI-4						
			]					
S	SLOT 4 - Auxiliary 6-Point 10					Aut <u>o</u> Scan	🕼 Update !	Apply

Figure 4-5. I/O Setup

**4.** Select the types of **I/O** to use.

- **5.** If you select analog inputs (AI), select the **250 Ohm Resistor Installed** option if you want the analog input in the current loop mode.
- 6. Click Apply.

**Note:** Make sure you select the I/O types **before** you configure the I/O using ROCLINK 800.

#### 4.6 Analog Inputs (AI)

Analog inputs (AI) monitor current loop and voltage input devices. The 12-bit A/D signal input range is 0 to 100% EU value (where 0% EU is 643 counts and 100% EU is 3220 counts). You configure the analog inputs using ROCLINK 800 software.

#### Notes:

- The type E diagnostic analog inputs (logic voltage, battery voltage, charge in, system milliamps, and battery temperature) are not designed to be configured or wired.
- Select AI as the I/O Type for the selectable analog input/discrete input when you configure it for use as an analog input. Refer to *Figure 4-5*.

The analog input (AI) channels are scalable, but typically measure either:

- 4 to 20 mA analog signal.
- 1 to 5 volts dc signal.

If required, you can calibrate the low end of the analog signal to zero.

The terminal blocks can accommodate size 16 to 24 AWG.

#### 4.6.1 Wiring the Analog Inputs

The terminals for connecting the analog input wiring are shown in *Figures 4-6* and *4-7*.

The + terminal is the positive signal input and the GND terminal is the signal common (–). These terminals accept a voltage signal in the 0 to 5 volt range. The GND terminal is internally connected to common so the analog input channels function as single-ended inputs only. Use the LOOP terminal to power external devices.

# Wiring the LoopUsing ROCLINK 800, you can configure the CPU module's optionalPower OutputsI/O assembly to set the loop output power to 10 volts dc or 24 volts dc.

**Note**: If the input voltage is greater than the 10-volt loop, then the loop voltage equals the input voltage. For example, if the PWR IN is

14 volts dc and you select a 10-volt loop, the loop output equals 14 volts dc.

The I/O module only supports 24 volts dc loop output power. The CPU module's I/O assembly uses the CPU's loop power output and ground connections.

The intent of the loop output power is to power devices (such as Rosemount transmitters) that require 24 volts dc to ground and then send the FB107 a 4 to 20 mA signal based on pressure, temperature, level and such.

The 10-volt loop output power is intended for low power transmitters that send a 1 to 5 volts dc rather than a 4 to 20 mA signal.

The loop current is designed to deliver 80 mA to power two field devices that connect back to the two analog inputs.



Figure 4-6. Loop Output Power for the CPU Module's Optional I/O Assembly



Figure 4-7. Loop Output Power for the I/O Module

## 4.7 Analog Outputs (AO)

The analog outputs (AO) provide a 4 to 20 mA current source output for powering analog loop devices. Analog outputs are analog signals the FB107 generates to regulate equipment, such as control valves or any device requiring analog control. The AO includes the power supply connections. The analog outputs use a 12-bit D/A converter with default A/D values of 0 and 3250 (0 to 100% EU values).

**Note:** Select AO as the I/O Type for the selectable analog output/discrete output when you configure it for use as an analog output. Refer to *Figure 4-5*.

#### 4.7.1 Wiring the Analog Outputs

The analog output provided on the I/O connects as follows:

- AO+ Positive
- AO- Common

**Note**: Be aware that you can induce ground loops by tying commons from various I/O together.

Figure 4-8 shows wiring for the analog output.



Figure 4-8. Analog Output Wiring

# 4.8 Discrete Inputs (DI)

The discrete input (DI) monitors the status of relays, open collector/open drain type solid-state switches, and other two-state devices. Discrete inputs come from relays, switches, and other devices, which generate an on/off, open/close, or high/low signal.

The DI provides a source voltage for dry relay contacts or for an opencollector solid-state switch.

Each DI channel can be software-configured to function as:

- Standard discrete inputs.
- Latched discrete inputs.

A latched DI remains in the active state until reset. Other parameters can invert the field signal and gather statistical information on the number of transitions and the time accumulated in the on- or off-state.

The DI senses the low voltage, which signals the FB107 electronics that the relay contacts have closed. The opening of the contacts allows the voltage to rise and the DI signals the FB107 electronics that the relay contacts have opened. An FB107 can read a DI a maximum of 20 times per second (50 millisecond scan).

When a field device (such as a relay contact or open collector) is connected across + and GND, the closing of the contacts completes the circuit This activates current flow that the DI circuitry senses and, in turn, signals the FB107 electronics indicating that the relay contacts have closed. **Note:** Select DI as the I/O Type for the selectable pulse inputs/discrete inputs when you configure it for use as a discrete input. Refer to *Figure 4-5*.

### 4.8.1 Wiring the Discrete Inputs

The terminals for connecting the DI wiring are shown in *Figure 4-9*. The + terminal is the positive signal input and the GND terminal is the signal common (–). The discrete input operates by providing a closed contact across terminals + and GND. Refer to *Figure 4-9*.

**Note**: Be aware that you can induce ground loops by tying commons from various I/O together.

**Caution** The discrete input is designed to operate only with non-powered discrete devices, such as "dry" relay contacts, open collector devices, or isolated solid state switches. Use of the DI channel with powered devices may cause improper operation or damage.



Figure 4-9. Discrete Input Wiring

## 4.9 Discrete Outputs (DO)

The discrete output (DO) provides two-state outputs to energize solidstate relays and power small electrical loads. A discrete output may be set to send a pulse to a specified device. Discrete outputs are high and low outputs used to turn equipment on and off.

The DO circuitry is optically coupled to help isolate the processor board from the input signal. Refer to *Figure 4-10*.

DO functions include:

- Sustained discrete outputs.
- Momentary discrete outputs.
- Toggled output.
- Time duration output.

The discrete output channel is a normally-open, FET switch. The discrete output is a solid-state switch enabled by individual signals from the processor I/O lines and capable of handling 50 Volts dc at 0.2 A maximum.

You configure the DO so that after a reset the DO retains the last value or switches off. When a request is made to change the state of a DO, the request is immediately sent to the DO. There is no scan time associated with a change of DO.

If the DO is in momentary or toggle mode, you can enter a minimum time-on of 50 milliseconds (.05 seconds).

Notes:

- Select DO as the I/O Type for the selectable analog output/discrete output when you configure it for use as a discrete output. Refer to *Figure 4-5*.
- When using the discrete output to drive an inductive load (such as a relay coil), place a suppression diode across the load. This protects the DO from the reverse Electro-Motive Force (EMF) spike generated when the inductive load is switched off.

#### 4.9.1 Wiring the Discrete Outputs

The terminals for connecting the DO wiring are shown in *Figure 4-10*. The "+" terminal is the high side of the switch and the "–" terminal is the low side.

**Note**: Be aware that you can induce ground loops by tying commons from various I/O together.

▲ Caution

The discrete output (DO) only operates with non-powered discrete devices, such as relay coils or solid-state switch inputs. Using the DO with powered devices may cause improper operation or damage.


Figure 4-10. Discrete Outputs

#### 4.10 Pulse Inputs (PI)

Pulse inputs (PI) processes signals from pulse-generating devices and provide a calculated rate or an accumulated total over a configured period. The FB107 pulse input circuits are physically the same as the discrete inputs. The pulse input routes to a pulse accumulator, where the pulses are counted and accumulated.

The PI is most commonly used to interface to open collector/open drain type solid-state devices. The PI can be used to interface to either self-powered or FB107-powered devices.

Acceptable PI voltage levels range between 0.5 volts dc (low) and 1.5 volts dc (high).

Caution The pulse input only operates with non-powered devices, such as "dry" contacts or isolated solid-state switches. Use of the PI with powered devices may cause improper operation or damage.

**Note:** Select PI as the I/O Type for the selectable pulse inputs/discrete inputs when you configure it for use as a pulse input. Refer to *Figure 4-5*.

## 4.10.1 Wiring the Pulse Inputs

*Figure 4-11* shows the terminals for connecting the PI wiring. The + terminal is a positive source voltage; the GND terminal is the signal return.

To use the channel as a pulse input, connect the + and GND field wires to terminals PI1+ or PI2+ and GND.

**Note**: Be aware that you can induce ground loops by tying commons from various I/O together.



Figure 4-11. Pulse Input Wiring

## 4.11 Resistance Temperature Detector (RTD) Input

The resistance temperature detector (RTD) on the CPU monitors the temperature signal from an RTD source. The RTD can accommodate input from a three- or four-wire RTD source. The RTD has a measurement range of -40 to  $400^{\circ}$ C (-40 to  $752^{\circ}$ F). The terminals for the RTD wires are labeled "RTD" on the CPU.

The active element of an RTD probe is a precision, temperaturedependent resistor made from a platinum alloy. The resistor has a predictable positive temperature coefficient, meaning its resistance increases with temperature. The RTD input works by supplying a small consistent current to the RTD probe and measuring the voltage drop across it. Based on the voltage curve of the RTD, the FB107 firmware converts the signal to temperature. The RTD input draws power for the active circuitry from lines on the backplane.

It may be more convenient to perform calibration before connecting the field wiring. However, if the field wiring between the FB107 and the RTD probe is long enough to add a significant resistance, then perform calibration in a manner that considers this. (According to RTD charts, as little as 0.23 ohms adds 1°F.)

During operation, the RTD is read once per second. The value from the RTD is linearized, and then it is sent to processing as an analog input. The AI routine converts this value to engineering units, and checks alarming.

#### 4.11.1 Wiring the RTD Input

Temperature can be input through the resistance temperature device (RTD) probe and circuitry. An RTD temperature probe mounts directly to the piping using a thermowell. The RTD measures the flowing temperature.

Protect RTD wires either by a metal sheath or by conduit connected to a liquid-tight conduit fitting. The RTD signal will be monitored by a 16-bit A/D converter and then be read by the microprocessor.

The FB107 provides terminations for a four-wire 100-ohm platinum RTD with an alpha equal to  $0.00385\Omega/^{\circ}C$ .

Wiring between the RTD probe and the FB107 must be shielded wire, with the shield grounded only at one end to prevent ground loops. Ground loops cause RTD input signal errors.

**Note**: Be aware that you can induce ground loops by tying commons from various I/O together.

*Table 4-3* displays the connections at the RTD terminals and 3-wire jumper requirements. *Figure 4-12* shows the RTD sensor wiring.

Terminal	Wiring Color	Designation	4-Wire RTD	3-Wire RTD
SRC	Red	Signal source current positive input	SRC	SRC
+	Red	+ RTD	+ RTD	+ RTD
_	White	– RTD	– RTD	– RTD
GND	White	Negative ground return reference	GND	GND jumper to – RTD

#### Table 4-3. RTD Wiring

Note: The wire colors for the RTD being used may differ.



Figure 4-12. RTD Sensor Wiring

# **Chapter 5 – Communications**

The FB107 communicates to external devices through its local operator interface port (LOI), the COM1 EIA-485 (RS-485) port, the COM2 EIA-232 (RS-232 port), or optionally on COM3 using a communications module.

The communication terminals and communications modules provide communications between the FB107 and a host system or external devices. The communications modules install directly onto the FB107 backplane and activate the host port when installed.

#### In This Chapter

5.1	Communications Overview	5-1
5.2	Installing/Removing a Communications Module	5-4
5.3	Wiring the Local Operator Interface (LOI) Port	5-5
	5.3.1 Using the LOI	5-5
5.4	Wiring EIA-485 (RS-485) Communications	5-6
5.5	Wiring EIA-232 (RS-232) Communications	5-7
5.6	Wiring the Liquid Crystal Display (LCD)	5-8

#### 5.1 Communications Overview

The FB107 CPU module provides three built-in communication ports. You can add **one** communications module to slot 1 in the base unit.





Figure 5-1. EIA-232 (RS-232) Communications Module

Figure 5-2. EIA-485 (RS-485) Communications Module



Figure 5-3. CPU

The FB107 supports up to four communication ports including:

 Local Operator Interface (RS-232C) – LOI for asynchronous serial communications, with DB9 connector. Defaults for the LOI are 19,200 baud rate, 8 data bits, no parity, and 1 stop bit.

Note: Local Port is labeled LOI on the CPU.

EIA-485 (RS-485) – COM1 for asynchronous serial communications. Standard for differential data transmission over distances of up to 1220 m (4000 ft). EIA-485 (RS-485) provides asynchronous serial communications for multi-drop units on a serial network over long distances using inexpensive twisted-pair cables. Defaults for the EIA-485 (RS-485) are 19,200 baud rate, 8 data bits, no parity, and 1 stop bit.

**Note:** COM1 is labeled 485 on the CPU.

 EIA-232 (RS-232) Default – COM2 for serial communications. Standard for single-ended data transmission over distances of up to 15 m (50 ft). EIA-232 (RS-232) provides point-to-point asynchronous serial communication. EIA-232 (RS-232) communications commonly provide the physical interface for connecting serial devices, such as gas chromatographs and radios. Defaults for the EIA-232 (RS-232) are 19,200 baud rate, 8 data bits, no parity, and 1 stop bit.

#### Notes:

- COM2 is located on the CPU.
- When you install a communications module in slot 2, the firmware redirects the CPU module's communications port (COM2) to the type of module installed in slot 2. Configure COM2 based on the type of communication module installed in slot 2.
- Optional communication modules COM3 includes EIA-232 (RS-232) and EIA-485 (RS-485) communications. Located on the communications module.

**Note:** COM3 is only activated when a communications module is installed in slot 1.

Use ROCLINK 800 to configure the modules.

Each communications module uses a separate, single-ended channel from the other modules. The field interface protects the electronics in the module. Each module reduces the effect of noise on communication errors through filtering.

LEDs display the RX (receive) and TX (transmit) signals for EIA-232 (RS-232) communications.

LEDs display the A (transmit/receive+) and B (transmit/receive -) signals for EIA-485 (RS-485) communications.

The FB107 has the capability to communicate with other devices using ROC or Modbus protocols. The firmware can automatically detect the two protocols (ROC or Modbus) at baud rates of up to 115.2 Kbps.

ROC protocol supports serial communications to local or remote devices, such as a host computer.

An FB107 can act as a Modbus host or slave device using Remote Terminal Unit (RTU) or American Standard Code for Information Interchange (ASCII) modes. This allows you to easily integrate the FB107 into other systems. Extensions to the Modbus protocol allow the retrieval of history, event, and alarm data in Electronic Flow Metering (EFM) Measurement applications.

Note: The LOI port only supports ROC or Modbus slave protocols.

#### 5.2 Installing/Removing a Communications Module

All FB107 modules are designed for ease of installation and removal. Refer to *Installing a Module*, *Removing a Module*, *and Wiring a Module* in *Chapter 4*, *Inputs/Outputs and RTD Inputs*, for specific instructions.

You can install communications modules in slots 1 or 2 on the base unit, which provides power and control signals to those modules.

Slot 1 Installing a communications module in slot 1 on the base unit activates COM3. COM2 is not affected; it still resides on the CPU. COM3 is completely independent of any other communication port.

**Note:** When you install a communications module in slot 1, you can also install an I/O module in slot 7. This provides a full complement of 42 I/O points and four communication ports.

**Slot 2** Installing a communications module in slot 2 on the base unit disconnects the CPU module's COM2 and redirects COM2 to the newly installed communication module. COM2 always exists.

**Note:** When you install a communications module in slot 2, the firmware redirects the CPU module's communication port (COM2) to the type of module installed in slot 2. Configure COM2 based on the type of communications module installed in slot 2.

The hardware decides which signals to use depending on whether a communication module is installed in slot 2. All other communication ports are not affected.

## 5.3 Wiring the Local Operator Interface (LOI) Port

The Local Operator Interface (LOI) port provides a direct, local link between the FB107 and a PC through an optional Local Operator Interface Cable using EIA-232 (RS-232C) communications.

Note: You can purchase an LOI cable from your sales representative.

Default values for the LOI port are: 19,200 baud rate, 8 data bits, 1 stop bit, no parity, 10 millisecond key-on delay, and 10 millisecond key-off delay. The maximum baud rate is 115.2 Kbps.

The LOI allows you to access the FB107 for configuration and transfer of stored data. The LOI port is capable of initiating a message in support of Spontaneous-Report-by-Exception (SRBX) alarming.

The LOI uses the Local Port in ROCLINK 800 software.

The LOI terminal on the CPU module provides wiring access to a builtin EIA-232 (RS-232C) serial interface. The LOI is softwareconfigurable with baud rates from 300 to 115.2 Kbps and uses a DB9 connection.

LEDs display the RX (receive) and TX (transmit) signals for EIA-232 (RS-232) communications.

The LOI supports ROC or Modbus slave protocol communications. The LOI also supports the log-on security feature of the FB107, if you enable security on the LOI using ROCLINK 800.

*Table 5-1* shows the signal routing of the CPU and PC connections. The FB107's EIA-232 (RS-232) transmit (TX) connects to the PC's receive (RX).

Table 5-1. LOI Port Null-modem Cable Wiring



#### 5.3.1 Using the LOI

- **1.** Plug the LOI cable into the LOI connector on the top of the FB107 base unit.
- **2.** Connect the LOI cable to the PC's COM port.
- **3.** Connect to ROCLINK 800 software and log in.
- **4.** Click the Direct Connect icon.

**5.** Configure communications for the other built-in and modular communications, I/O modules, AGA meter parameters, and other configuration parameters.

#### 5.4 Wiring EIA-485 (RS-485) Communications

The EIA-485 communications provides for RS-485 signals on:

- COM1 port located on the CPU (labeled 485).
- COM2 located on the CPU when a communications module is installed in slot 2.
- COM3 located on the EIA-485 (RS-485) communications module installed in slot 1.

*Table 5-2* shows termination points for EIA-485 (RS-485) communications.

The EIA-485 (RS-485) serial communication allows baud rates from 300 to 115.2 Kbps with standard differential data transmissions over distances of up to 1220 meter (4000 feet). The EIA-485 (RS-485) drivers are designed for multi-point applications with multiple devices on a single bus.

EIA-485 (RS-485) supports the log-on security feature of the FB107 if you enable security on the communication port using ROCLINK 800.

LEDs display the A (transmit/receive+) and B (transmit/receive -) signals for EIA-485 (RS-485) communications.

Default values for the EIA-485 (RS-485) communications module are: 19,200 baud rate, 8 data bits, 1 stop bit, no parity, 10 millisecond key-on delay, and 10 millisecond key-off delay. The maximum baud rate is 115.2 Kbps.

Wiring should be twisted-pair cable. The terminals and their functions are Pin 1 is Terminal A and Pin 2 is Terminal B. Connect A on the FB107 to A or "+", and connect B on the FB107 to B or "-". Should you encounter difficulties establishing a connection, try reversing the connections.

Note: EIA-485 (RS-485) standards suggest placing a terminating resistor at the end of the line. The value of each termination resister should equal the cable impedance (typically  $120\Omega$  for twisted pair).

Label	Definition
А	Transmit / Receive +
В	Transmit / Receive –
NC	No connection (comm module only)
NC	No connection (comm module only)
NC	No connection (comm module only)
GND	Ground (common)

Table 5-2. EIA-485 (RS-485) Field Wiring Terminals

## 5.5 Wiring EIA-232 (RS-232) Communications

The EIA-232 communications meets EIA-232 specifications for singleended, RS-232 asynchronous data transmission over distances of up to 15 m (50 ft). *Table 5-3* shows termination points for EIA-232 (RS-232) communications.

The EIA-232 communications provides for RS-232 signals on:

- LOI port located on the CPU.
- COM2 located on the CPU.
- COM3 located on the EIA-232 (RS-232) communications module installed in slot 1.

EIA-232 (RS-232) uses point-to-point asynchronous serial communications and is commonly used to provide the physical interface for connecting serial devices, such as gas chromatographs and radios to the FB107. The EIA-232 (RS-232) communication provides ready-to-send (RTS) hand-shaking lines.

The EIA-232 (RS-232) default values are: 19,200 baud rate, 8 bits, 1 stop bit, no parity, 10 millisecond key-on delay, and 10 millisecond key-off delay. The maximum baud rate is 115.2 Kbps.

EIA-232 (RS-232) supports the log-on security feature of the FB107 if you enable the security on the communication port using ROCLINK 800.

The EIA-232 (RS-232) signals include RX, TX, and RTS signal/control lines. Light-emitting diodes (LEDs) indicate if the FB107 is transmitting (TX) or receiving (RX).

Label	Definition
ТХ	Transmit data signals that data is being transmitted from the comm port
RX	Receive data signals that data is being received at the comm port
RTS	Ready to Send signals that the port is ready to transmit
NC	No connection (comm module only)
NC	No connection (comm module only)
GND	Ground (common)

Table 5-3. EIA-232 (RS-232) Field Wiring Terminals

## 5.6 Wiring the Liquid Crystal Display (LCD)

The FB107 base unit provides connections for an optional liquid crystal display (see *Figure 5-4*). The display functions as an EIA-232 (RS-232) communications device, supporting ROC or Modbus slave communications protocols.

The LCD default values are: 19,200 baud rate, 8 data bits, 1 stop bit, no parity. The maximum baud rate is 57.6 Kbps.



Figure 5-4. Display Connection on Base Unit

Table 5-4. LCD Connections

Label	Function	
1	Power Out	
2 Ground		
3 Transmit (TX) from FB10		
4 Receive (RX) to FB107		

# Chapter 6 – Multi-Variable Sensor (MVS)

The Multi-Variable Sensor (MVS) module provides differential pressure, static pressure, and temperature inputs to the FB107 for orifice flow calculation.

#### In This Chapter

6.1 MVS Overview	6-1
6.2 Installing/Removing an MVS Module	6-3
6.3 Configuring a Multi-drop MVS Module Setup	6-3
6.4 MVS Lightning Protection	6-5

#### 6.1 MVS Overview

The MVS module provides communications and power to remote MVS transmitters. You can install one MVS module in the FB107.

The MVS module consists of interface electronics that provide the communications link between the FB107 and the MVS. The interface electronics controls communications with the sensor module, provides scaling of process variables, aids calibration, stores operating parameters, performs protocol conversion, and responds to requests from the FB107.

The MVS module provides the communications interface and the short-circuit current-limited power required to connect up to six MVS transmitters.

You can install the MVS module in any slot on the FB107 and expansion rack except for slot 0, where the CPU module resides.

The FB107 allows six MVS transmitters to be connected on its communications bus in a multi-drop connection scheme. You must set the address of each MVS **prior** to final wiring of multiple MVS devices. For proper operation of multiple MVS devices, each MVS device must have a unique address (in the range 1—239). **None** of the addresses can be 0 or 240.

Note: You set MVS Values using ROCLINK 800's MVS Sensor screen (Configure > I/O > MVS Sensor).

Once you set a unique address for each MVS, connect the MVS units in a multi-drop arrangement. The only requirement for wiring multi-drop devices is that you tie all like terminals together. This means all the "A" terminals on the devices are electrically connected to the FB107's "A" terminal and so on.

You can daisy-chain wire through each remote MVS. Refer to *Figure 6-1*.

MVS modules have removable terminal blocks for convenient wiring and servicing. The terminal blocks can accommodate size 16 to 24 AWG.

The FB107 scans each MVS transmitter once every second, accessing values for differential pressure, static pressure, and temperature as inputs for flow calculations, history, calibration, and alarming.

Each input unit is based on selected system units:

	Differentia I Pressure Units	Static Pressure Units	Temperature Units
English Units	InH₂O	PSI	Deg F
Metric Units	kPa	kPa	Deg C



Figure 6-1. MVS Wiring

The MVS provides static pressure, differential pressure, and process temperature inputs. The MVS measures the three flow-related variables simultaneously. These variables are continuously available to the FB107 that polls the MVS.

The MVS operates as a remote or integral unit that communicates via a serial format.

The MVS consists of a transducer and an interface circuit. The transducer, contained in the sensor body, uses capacitance-cell technology to sense differential pressure and piezo-resistive technology to sense the static (absolute or gauge) pressure.

The transducer electronics convert the pressure variables directly into a digital format, allowing accurate correction and compensation. The FB107 converts the raw temperature into digital format. A microprocessor linearizes and corrects the raw pressure signals (from the sensor) using characterization data stored in non-volatile memory.

The interface circuit allows the MVS to connect to and communicate with an FB107 using a serial 2-wire EIA-485 (RS-485) connection.

#### 6.2 Installing/Removing an MVS Module

All FB107 modules are designed for ease of installation and removal. Refer to *Installing a Module, Removing a Module,* and *Wiring a Module* in *Chapter 4, Inputs/Outputs and RTD Inputs,* for specific instructions.

Note: Modules contain no user-serviceable components.

You can install an MVS module in any slot on the FB107 base unit or expansion rack with the exception of slot 0, which is reserved for the CPU.

Caution Never connect the sheath surrounding shielded wiring to a signal ground terminal or to the common terminal of a MVS module assembly. Doing so makes the MVS module susceptible to static discharge, which can permanently damage the module. Connect the shielded wiring sheath only to a suitable earth ground.

#### 6.3 Configuring a Multi-drop MVS Module Setup

To configure a multi-drop MVS setup, connect each MVS to the FB107 unit one at a time. Ensure that each MVS functions correctly before installing the next MVS.

**Note:** There is a possibility of losing the FB107 configuration and historical data held in RAM while performing the following procedure. As a precaution, save the current configuration and historical data to permanent memory.

Caution When installing units in a hazardous area, make sure all installation components selected are labeled for use in such areas. Installation and maintenance must be performed only when the area is known to be non-hazardous. Installation in a hazardous area could result in personal injury or property damage.

Always turn off the power to the FB107 before you attempt any type of wiring. Wiring of powered equipment could result in personal injury or property damage.

To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.

- **1.** Remove power from the FB107.
- 2. Wire the MVS. The MVS is labeled as in *Table 6-1*.

Terminal	Label	Definition
1	A	Receive / Transmit +
2	В	Receive / Transmit –
3	NC	No Connection
4	NC	No Connection
5	PWR	+ (Sensor Power)
6	GND	– (Common)

Table	6-1.	MVS	Wiring	Termina	als
-------	------	-----	--------	---------	-----

**3.** Run four wires from the FB107 to the MVS, and connect them to the MVS terminal block on the MVS module. The wires should be size 16 to 24 AWG and a maximum length of 1220 meters (4000 feet). Two of the terminals provide power and the other two terminals provide a communication path.

Note: Do not reverse the power wires. Always make these connections after you remove power from the FB107. Double-check for proper orientation before applying power. If the connections are reversed and you apply power, the MVS and the FB107 may be damaged.

- 4. Connect the FB107 and remote MVS terminals.
- **5.** Connect the remote MVS to a suitable earth ground per applicable codes and standards.
- 6. Set the address of each MVS prior to final wiring of multiple MVS devices. For proper operation of multiple MVS devices, each MVS device must have a unique address. The FB107 allows you to connect up to six MVS devices on its communications bus in a multi-drop connection scheme.

- **Note:** All MVS units are sent from the factory with a default interface address of **1**. This allows you to accomplish first-time communications.
- 7. Once you set a unique address for each MVS in the multi-drop configuration, connect like terminals to like (that is, electrically connect all the "A" terminals on the devices to the FB107 "A" terminal, and so on). The wiring must be done entirely from the FB107 (daisy-chained) though each remote MVS as shown in *Figure 6-2*.



Figure 6-2. MVS Multi-Drop Configuration

#### Notes:

- Do not use Address 240 in multi-drop applications, because all MVS devices with this address try to respond to requests from the FB107.
- When configuring a multi-drop MVS setup, connect each MVS to the FB107 one at a time. Ensure that each MVS is functioning correctly before you install the next MVS.

## 6.4 MVS Lightning Protection

To safeguard against lightning strikes, install surge suppression devices. The following commercially available lightning protection modules have been found to meet requirements:

- Model Number LPC 10643 485: Protects the communication pair (A and B terminals).
- Model Number LPC 10643 1: Protects the power and ground pair (PWR and GND terminals).

These units are available from:

Lightning Protection Corporation PO Box 6086 Santa Barbara, CA 93160 Telephone: 1-800-317-4043 http://www.lightningprotectioncor.com/

# Chapter 7 – Troubleshooting

This chapter provides generalized guidelines for troubleshooting the FB107. Perform the procedures in this chapter before removing power for any reason, after you restore power, and if you disassemble the FB107.

The following tools are required for troubleshooting:

- IBM-compatible personal computer.
- ROCLINK 800 software.
- Flat-head (size 1/10 inch) screwdriver.
- Philips (size 0) screwdriver.

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#### 7.1 General Guidelines

When you are attempting to diagnose a problem with a FB107:

- Write down what steps you have taken.
- Save the configuration and log data (refer to Section 7.3.4, Preserving Configuration and Log Data).
- Note the order in which you remove components.
- Note the orientation of the components before you alter or remove them.
- Read and follow all cautions in this manual.

When you finish troubleshooting, perform the restart procedure in *Section 7.4.2, Restarting and Reconfiguring the FB107.* 



## 7.2 Graphical User Interface (GUI)

line.

The FB107's graphical user interface (GUI) provides visual clues to help you diagnose problems.

Once you successfully log onto ROCLINK 800 and connect to the FB107, the GUI displays (see *Figure 7-1*).



Figure 7-1. FB107 GUI

The **I** in a red box indicates an **integrity** alert. The **A** in a yellow box indicates an **alarm**. This example screen shows a red integrity alert on the CPU module's I/O assembly, and both an integrity alert and an

alarm on the I/O module in slot 2. Note that the screen below the FB107 image provides additional information on the alerts or alarms.

Situations that could cause integrity alerts include:

• **Communications failures**: A module has failed or has been removed.

Note: This error occurs on I/O modules and MCS modules.

- **Module mismatch**: The CPU expected to see one kind of module and you actually installed another.
- **I/O points are out of range**: For example, the AI point default A/D counts are 643 to 3220. If the AI is open and the FB107 reads 0 A/D counts, the FB107 generates an integrity alert.

Integrity alerts are typically related to hardware. Alarms are typically related to user-defined configurations.

For more information on the FB107 GUI, refer to the *ROCLINK* 800 *Configuration Software User Manual (for FloBoss 107)* (Form A6217).

#### 7.3 Checklists

This section provides brief topical checklists.

#### 7.3.1 LEDs

If the LEDs do not display on the **CPU** or the **modules**:

- Verify the CPU power input is a minimum of 8 volts dc.
- Ensure power is applied to the FB107.
- Verify the wiring connections at PWR+ and PWR-.
- Verify the wiring connections at the power source.
- Test and reseat the terminal blocks.
- Verify all module power inputs are adequate.
- Verify the input polarity is correct.
- Ensure the module is fully seated in the backplane.

**Note**: The Power In+ LED should be the only LED always on. All other LEDs flash only during communication.

#### 7.3.2 Serial Communications

If you are experiencing troubles with a **serial communications** connection (LOI, EIA-232, or EIA-485):

- Ensure that power is applied to the FB107.
- Verify the wiring connections at PWR+ and PWR-.
- Verify the wiring connections at the power source.

• Verify the wiring connections at TX, RX, A, B, and GND. Refer to *Chapter 5, Communications*.

**Note**: The Power In+ LED should be the only LED always on. All other LEDs flash only during communication.

Verify the communication port settings in ROCLINK 800 (ROC > Comm Ports).

**Note**: You must perform a power re-start to allow ROCLINK 800 to identify the module.

## 7.3.3 Inputs/Outputs

If you are experiencing troubles with an **I/O point** (analog input, analog output, discrete input, discrete output, pulse input, or RTD):

- Ensure that power is applied to the FB107.
- Verify the wiring connections at PWR+ and PWR-.
- Verify the wiring connections at the power source.
- Verify how the channel is configured using ROCLINK 800 software (Configure > I/O).
- If the configuration looks correct, then simulate an input (within the range of the input) or force the production of an output using ROCLINK 800 software:



• If I/O does functions correctly, determine if the problem is with the field device or the loop power:



- If the types of I/O available for configuration do not match the type of I/O wired to the terminations, check the I/O Setup screen (refer to *Chapter 4, Inputs/Outputs and RTD Input*).
- If an input channel is in question, you may be able to use one of the outputs (known to be in working order) to simulate the required input. Likewise, if an output channel is in question, you may able to connect it to a working input channel and check the results.

Notes:

- FB107 modules do not contain any user-serviceable parts.
- You must perform a power restart to allow ROCLINK 800 to identify the module.

#### 7.3.4 Preserving Configuration and Log Data

Before you power down the FB107 to repair or upgrade, to remove or add a component, or to troubleshoot, you should preserve the FB107 configuration and log data held in RAM.

Caution When installing equipment in a hazardous area, ensure that all components are approved for use in such areas. Check the product labels. Change components only in an area known to be non-hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.

To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.

- 1. Connect to ROCLINK 800 and connect to the FB107.
- Ensure that the configuration is saved in flash memory. Select ROC > Flags > Save to Flash Memory. This saves all configuration settings, including the current states of the ROC Flags and calibration values.
- **3.** Select **ROC** > **Collect Data**.
- 4. Type the desired File name for the backup file, or use the default.
- 5. Click Save.
- **6.** Click **OK**. This saves event logs, alarm logs, report data, and history, but not non-EFM history points. You can specify your own file name and path if desired.
- 7. Select File > Save Configuration. The Save As dialog box appears.
- 8. Enter a File name.
- **9.** Click **Save**. ROCLINK 800 saves the file in the default directory C:/Program Files/ROCLINK 800/Data unless you changed the directory.

#### 7.3.5 ROCLINK 800 Configuration Software

If you are experiencing problems with the FB107 that appear to be **software**-related, try resetting the FB107.

- **Note**: Download history, events, and alarm logs prior to a restart. **Before** you attempt any type of reset, back up your configuration and log data. Refer to *Preserving Configuration and Log Data*.
- Use a warm start to restart without losing configuration or log data. To perform a warm start, open ROCLINK 800 software, connect to the FB107 and select ROC > Flags. Click Warm Start on the Flags screen.
- Use a cold start to restart without a portion of the configuration, log data, or programming that may be the trouble. To perform a cold start, open ROCLINK 800 software, connect to the FB107 and select ROC > Flags. Click Cold Start on the Flags screen.
- Following a warm start and a cold start, if you still cannot connect **and** you cannot connect to the FB107 using the LOI port, use the reset switch on the FB107's CPU module and cycle power to restore the LOI communications parameters to factory defaults. Refer to *Section 7.4.1, Resetting the FB107.*

**Note:** If these methods do not solve the problem, contact your local sales representative.

## 7.3.6 Powering Up

If you are experiencing trouble with **powering up** the FB107:

- Ensure that power is applied to the FB107.
- Verify the wiring connections at PWR+ and PWR-.
- Verify the wiring connections at the power source.
- Verify the input voltage, which should be a minimum of 8 volts dc (refer to *Chapter 3, Power Connections*).

**Note:** If these methods do not solve the problem, contact your local sales representative.

## 7.3.7 Multi-Variable Sensor (MVS)

If you are experiencing trouble with a MVS point:

- Review Chapter 6, Multi-Variable Sensor (MVS).
- Use ROCLINK 800 to see how the channel is configured.
- If more than one MVS is connected to the FB107, use the Multi-Variable Sensor screen (Configure > I/O > MVS Sensor) to ensure that each MVS has a unique address.
- If the MVS Sensor screen displays letters (such as *NAN0*) for any of the input readings, there is likely a floating-point error in the sensor.

Attempt to reset the MVS back to factory default settings. Refer to *Resetting the MVS to Factory Defaults* in *Section 7.4.10, Troubleshooting MVS.* 

## 7.3.8 Resistance Thermal Device (RTD)

If you are experiencing troubles with the RTD:

- Use ROCLINK 800 to verify that the on-board RTD point is configured as point number AI3 (RTD=AI3).
- If the configuration looks correct, then use ROCLINK 800 to produce a simulated input (within the range of the input) according to the following values:

84Ω	–40°C	–40°F
100Ω	O°C	32°F
250Ω	408°C	767°F
200Ω	267°C	512°F
150Ω	130°C	267°F

**Note**: These values are approximations only. **Do not** use these values to calibrate the device.

- Verify that the wiring to the RTD terminations is correct. Refer to *Chapter 4, Inputs/Outputs and RTD Inputs.*
- Verify that the user-supplied RTD probe is not faulty. Refer to the instructions that accompanied the RTD probe.

#### 7.4 Procedures

This section presents step-by-step produces to help you troubleshoot.

#### 7.4.1 Resetting the FB107

You reset the FB107 to perform a type of cold start that re-establishes a known operating point and loads the factory defaults into the communication ports. The reset (RST) switch is located on the CPU module, just above the RTD terminal block.

This cold start does not include any of the clearing options available in a cold start performed using ROCLINK 800 software.

**Note:** This type of reset restores the communications ports to the factory configuration defaults. Some user-entered configuration parameters may be lost. Therefore, back up any required data before performing this reset.

**1.** Refer to Section 7.3.4, Preserving Configuration and Log Data.

- **2.** Remove power from the FB107.
- **3.** Depress and hold down the reset (RST) switch.
- 4. While pressing the RST switch, reconnect the power to the FB107.
- 5. After the power LED flashes twice, release the RST switch.
- 6. Refer to Section 7.4.2, Restarting and Reconfiguring the FB107.

#### 7.4.2 Restarting and Reconfiguring the FB107

After removing power to the FB107 and performing maintenance or repair, perform the following steps to start your FB107 and reconfigure your data. The procedure assumes you are using ROCLINK 800.

▲ Caution	Ensure all input devices, output devices, and processes remain in a safe state upon restoring power. An unsafe state could result in property damage.		
	When installing equipment in a hazardous area, ensure that all components are approved for use in such areas. Check the product labels. Change components only in an area known to be non- hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.		
	1. Reconnect power to the FB107 unit by inserting the <b>PWR+ / PWR-</b> power terminal block.		
	<b>2.</b> Launch ROCLINK 800, log in, and connect to the FB107.		
	3. Select File > Download.		
	<b>4.</b> From the <b>Open</b> dialog box, select the backup configuration file (has extension *.800).		
	<b>5.</b> Select the configuration file you desire to restore.		

6. Click **Download** to restore the configuration.

#### 7.4.3 Troubleshooting Analog Inputs

Before you can determine if an analog input point is operating properly, you must first know its configuration. *Table 7-1* shows typical configuration values for an analog input:

Parameter	Value	Value Read
Adjusted A/D 0 %	643	1 volt dc across the + and the COM terminal by a multimeter
Adjusted A/D 100 %	3220	5 Volts dc across the + and the COM terminal by a multimeter
Low Reading EU	0.0000	EU value with 1 Volt dc
High Reading EU	100.0	EU value with 5 Volts dc

 Table 7-1. Analog Input Module Typical Configuration Values

	Required Equipment	:	Calibration source of 1 to 5 volts dc or 4-20 mA Multimeter PC running ROCLINK 800 software
	<b>A</b> Caution	Fa as da	ailure to exercise proper electrostatic discharge precautions, such wearing a grounded wrist strap may reset the processor or amage electronic components, resulting in interrupted operations.
		1.	Remove the field device connected to the transmitter.
		2.	Set the multimeter to measure voltage and connect it across the + and GND terminals.
		3.	Connect to ROCLINK 800.
		4.	Select Configure > I/O > AI Points.
		5.	Select the correct analog input point number.
		6.	Install a voltage source of 1 to 5 volts dc and verify the following readings:
			• When supplying 1 volt dc input, AI should indicate 1% EU.
			• When the reading goes outside the calibrated 0% and 100% A/D counts, ROCLINK 800 indicates point fail and the input reads and holds the last know good value or go to a user-defined value as determined by the AI configuration.
			• When supplying 5 volts dc, AI should indicate 100% EU.
		7.	Remove the test equipment.
7.4.4	Troubles	ho	oting Analog Outputs
	Required	٠	Multimeter
	Equipment	•	PC running ROCLINK 800 software
	▲ Caution	Fa as da Ei	ailure to exercise proper electrostatic discharge precautions, such wearing a grounded wrist strap may reset the processor or amage electronic components, resulting in interrupted operations. Insure that the area is a safe operating environment.
		1.	Secure the loop and remove it from service
		2	Determine whether the $\Delta \Omega$ is used in a DID loop. If it is remove the

- **2.** Determine whether the AO is used in a PID loop. If it is, remove the PID loop from service and take it off scan.
- **3.** Connect to ROCLINK 800.
- 4. Select Configure > I/O > AO Points.
- 5. Record the EU values shown on the Analog Output screen.
- **6.** Remove the field wiring from the AO port of the IO terminal block.

- **7.** Connect a current meter in series between the AO + and AO terminals.
- 8. Select the Analog Output point from the list.
- 9. Using ROCLINK 800, set the output to minimum EU value.
- **10.** Verify that the current meter indicates the low current needed for the loop.
- **11.** If the value does not meet the minimum current required, alter the Adjusted A/D 0% counts found in the AO point on the ROCLINK 800 screen until it does meet current requirements.
- 12. Using ROCLINK 800, set the output to maximum EU value.
- **13.** Using the current meter, verify that maximum loop current is being supplied.
- **14.** If the value does not meet the maximum current required, alter the Adjusted A/D 100% counts found in the AO point on the ROCLINK 800 screen until it does meet current requirements.
- **15.** Set the AO EU value to the range noted in step 5.
- **16.** Connect the field device.
- **17.** If the AO was used in a PID loop, re-able the PID loop and verify the operation is adequate.

#### 7.4.5 Troubleshooting Discrete Inputs

- **Required** Jumper wire
- **Equipment** PC running ROCLINK 800 software

Caution Failure to exercise proper electrostatic discharge precautions, such as wearing a grounded wrist strap may reset the processor or damage electronic components, resulting in interrupted operations.

Ensure that the area is a safe operating environment.

- **1.** Ensure that the IO point is safe to remove from service.
- **2.** Connect to ROCLINK 800.
- **3.** Remove the wiring from the termination points.
- 4. Select Configure > I/O > DI Points.
- 5. Select the correct DI point number.
- **6.** Place a jumper between the DI and the ground on the termination block.
- **7.** Using ROCLINK 800, verify that the status is on. (If the point is configured for inverted operation the status is off.)
- **8.** Remove the jumper between the DI point and the ground on the termination block.

- **9.** View ROCLINK 800 and verify that the status is off. (If the point is configured for inverted operation, the status is on.)
- **10.** Reconnect the field wiring and place the point back into service.

#### 7.4.6 Troubleshooting Discrete Outputs

Required Equipment	<ul><li>Multimeter</li><li>PC running ROCLINK 800 software</li></ul>	
<b>A</b> Caution	Failure to exercise proper electrostatic discharge precautions, such as wearing a grounded wrist strap may reset the processor or damage electronic components, resulting in interrupted operations. Ensure that the area is a safe operating environment.	
	<b>1.</b> Ensure that the IO point is safe to remove from service.	
	2. Connect to ROCLINK 800.	
	<b>3.</b> Select <b>Configure</b> > <b>I/O</b> > <b>DO Points</b> .	
	<b>4.</b> Record the discrete output state shown on the Discrete Output screen.	
	<b>5.</b> Remove the wiring from the termination block.	
	6. Select the correct DO point number.	
	<b>7.</b> Connect an ohm meter from the DO+ to the DO	
	<b>8.</b> When the DO is off, the ohm meter should indicate an open circuit.	
	<b>9.</b> Using ROCLINK 800, set the DO to the on state.	
	<b>10.</b> Verify that the ohm meter indicates less than 10 ohms.	
	<b>11.</b> Using ROCLINK 800, set the DO to the off state.	
	<b>12.</b> Reconnect the DO field wiring.	
	<b>13.</b> Set the DO to the state recorded in step 4.	
7.4.7 Troubles	shooting Pulse Inputs	
Required Equipment	<ul> <li>Pulse Generator</li> <li>Voltage Generator</li> <li>Frequency Counter</li> <li>Jumper wire</li> </ul>	
	<ul> <li>PC running ROCLINK 800 software</li> </ul>	

Caution Failure to exercise proper electrostatic discharge precautions, such as wearing a grounded wrist strap may reset the processor or damage electronic components, resulting in interrupted operations.

To verify 10 Khz operation:

- **1.** Connect to ROCLINK 800.
- 2. Select Configure > I/O > PI Points.
- **3.** Select the correct pulse input point number.
- **4.** Connect a pulse generator having sufficient output to drive the module to terminals + and GND. The pulse generator must synthesize a square wave signal of 50% for every cycle.
- **5.** Connect a frequency counter across terminals + and GND.
- 6. Set the pulse generator to a value equal to, or less than 10 KHz.
- 7. Set the frequency counter to count pulses.
- **8.** Verify, using ROCLINK 800 software, that the count read by the counter and the FB107 are the same.
- 9. Remove the test equipment, and reconnect the field device.

#### 7.4.8 Troubleshooting RTD Inputs

The RTD input is similar in operation to an analog input and uses the same troubleshooting and repair procedures.

Required Equipment	<ul><li>Multimeter</li><li>PC running ROCLINK 800 software</li></ul>	
<b>A</b> Caution	Failure to exercise proper electrostatic discharge precautions, such as wearing a grounded wrist strap may reset the processor or damage electronic components, resulting in interrupted operations.	
	1. Connect to ROCLINK 800.	
	2. Select Configure > I/O > AI Points.	
	<b>3.</b> Select the correct RTD analog input point number.	
	<b>4.</b> If the RTD opens, ROCLINK 800 indicates point fail by going outside the calibrated AD value 0% and 100% values. In fault mode, the input value is either the last known good value or is set to a preset value, as defined by the AI point configuration.	
	<ol> <li>Disconnect the RTD and connect a jumper between the – and GND RTD terminals and between the SRC and + of the RTD module.</li> </ol>	
	6. Connect either an accurate resistor or decade resistance box with a value to give a low end reading across terminals + and –. Refer to Table 7-2, which provides a temperature-to-resistance conversation chart.	

84Ω	_40°C	–40°F
250Ω	408°C	767°F
100Ω	O°C	32°F

 Table 7 -2. Temperature-to-Resistance Conversions

**Note**: These values are approximations only. **Do not** use these values to calibrate the device.

- **7.** Verify that the Raw A/D Input value changed and reflects the Adjusted A/D 0% value.
- **8.** Change the resistance to reflect a high temperature as determined by the temperature-to-resistance conversion chart.
- **9.** Verify that the Raw A/D Input value changed and reflects the Adjusted A/D 100% value.
- **10.** Measure between one red and one white with an ohm meter. The value should be between  $100\Omega$  and  $125\Omega$  at room temperature.
- **11.** Remove the test equipment.
- **12.** Reconnect the field device.

#### 7.4.9 Troubleshooting MVS

If your Multi-Variable Sensor (**MVS**) is not responding:

- 1. Connect to ROCLINK 800.
- 2. Select Configure > I/O > MVS Sensor.
- **3.** Select MVS Point Number in question.
- **4.** Ensure that the MVS is not in manual mode by setting the Scanning field to Enabled.
- **5.** If the sensor alarm shows a comm fail alarm, then the sensor is not communicating with the FB107.

# Resetting the MVS to<br/>Factory DefaultsIf you are having difficulty communicating with an MVS unit, reset<br/>the MVS to factory default settings. To restore factory default<br/>settings in an MVS:

- 1. Connect the FB107 to a PC running ROCLINK 800.
- 2. Select Utilities > MVS Calibration.
- 3. Click Set Back to Factory Defaults.
- 4. Click Yes.

#### Notes:

 The MVS module does not contain any user-serviceable parts. Return the MVS module to your local sales representative for repair or replacement.

- If you are troubleshooting an on-board RTD on the MVS module, refer to *Section 7.4.8, Troubleshooting RTD Inputs.*
- You must perform a power restart in order to have ROCLINK 800 identify the module.

# Appendix A – Glossary

Note: This is a generalized glossary of terms. Not all the terms may necessarily correspond to the particular device or software described in this manual. For that reason, the term "ROC" is used to identify all varieties of Remote Operations Controllers (including ROC800-Series, ROC300-Series, FloBoss<sup>™</sup> 103/104/, FloBoss 107, FloBoss 503/504, and FloBoss 407 units).

Α	
A/D	Analog to Digital signal conversion.
ABS	Acrylonitrile Butadiene Styrene.
ADC	Analog to Digital Converter. Used to convert analog inputs (AI) to a format the flow computer can use.
AGA	American Gas Association. A professional organization that oversees the AGA3 (orifice), AGA5 (heating value), AGA7 (turbine), AGA8 (compressibility), and AGA11 (ultrasonic) gas flow calculation standards. See http://www.aga.org.
AWG	American Wire Gauge.
AI	Analog Input.
AO	Analog Output.
Analog	Analog data is represented by a continuous variable, such as an electrical current signal.
Annubar	A device that uses Pitot tubes to measure the gas flow rate within a pipeline. The gas volume is calculated from the difference between the flowing pressure and the static pressure of the gas.
AP	Absolute Pressure.
API	American Petroleum Institute. See http://www.api.org.
Area	A user-defined grouping of database entities.
ASCII	American (National) Standard Code for Information Interchange.
Attribute	A parameter that provides information about an aspect of a database point. For example, the alarm attribute is an attribute that uniquely identifies the configured value of an alarm.
В	
BMV	Base Multiplier Value, used in AGA7 (turbine) calculations.
BPS	Bits Per Second, associated with baud rate.
BTU	British Thermal Unit, a measure of heat energy.
Built-in I/O	I/O channels that are fabricated into the ROC and do not require a separate option. Also called "on-board" I/O.
С	
C1D2	Class 1, Division 2 hazardous area
CMOS	Complementary Metal Oxide Semiconductor, a type of microprocessor used in a ROC.
Coil	Digital output, a bit to be cleared or set.
COL	Ethernet Packet Collision.

СОМ	Communications port on a personal computer (PC).	
СОММ	Communications port on a ROC used for host communications.	
Comm Module	Module that plugs into a ROC to provide a channel for communications via a specified communications protocol, such as EIA-422 (RS-422) or HART.	
CF	Compare Flag; stores the Signal Value Discrete (SVD).	
Configuration	Refers either to the process of setting up the software for a given system or the result of performing this process. The configuration activity includes editing the database, building schematic displays and reports, and defining user calculations. Typically, the software setup of a device that can often be defined and changed. Can also mean the hardware assembly scheme.	
Configuration Tree	In ROCLINK 800, the graphical display that appears when a configuration file opens. It is a hierarchical branching ("tree-style") method for navigating within the configuration screens.	
CPU	Central Processing Unit.	
CRC	Cyclical Redundancy Check error checking.	
Crosstalk	The amount of signal that crosses over between the receive and transmit pairs, and signal attenuation, which is the amount of signal loss encountered on the Ethernet segment.	
CSA	Canadian Standards Association. See http://www.csa.ca.	
CSMA/CD	Carrier Sense Multiple Access with Collision Detection.	
CTS	Clear to Send modem communications signal.	
D		
D/A	Digital to Analog signal conversion.	
DB	Database.	
dB	Decibel. A unit for expressing the ratio of the magnitudes of two electric signals on a logarithmic scale.	
DCD	<b>Data Carrier Detect</b> modem communications signal. In addition, <b>Discrete Control</b> <b>Device</b> – A discrete control device energizes a set of discrete outputs for a given setpoint and matches the desired result against a set of discrete inputs (DI).	
DCE	Data Communication Equipment.	
Deadband	A value that is an inactive zone above the low limits and below the high limits. The purpose of the deadband is to prevent a value (such as an alarm) from being set and cleared continuously when the input value is oscillating around the specified limit. This also prevents the logs or data storage location from being over-filled with data.	
Device Directory	In ROCLINK 800, the graphical display that allows navigation through the PC Comm Ports and ROC Comm Ports setup screen.	
DI	Discrete Input.	
Discrete	Input or output that is non-continuous, typically representing two levels (such as on/off).	
DMM	Digital multimeter.	
DO	Discrete Output.	
Download	The process of sending data, a file, or a program from a PC to a ROC.	
DP	Differential Pressure.	
DSR	Data Set Ready modem communications signal.	
DTE	Data Terminal Equipment.	
DTR	Data Terminal Ready modem communications signal.	
Duty Cycle	Proportion of time during a cycle that a device is activated. A short duty cycle conserves power for I/O channels, radios, and so on.	

	DVM	Digital voltmeter.
	DVS	Dual-Variable Sensor. A device that provides static and differential pressure inputs to a ROC.
Ε		
	EEPROM	Electrically Erasable Programmable Read-Only Memory, a form of permanent memory on a ROC.
	EFM	Electronic Flow Metering or Measurement.
	EIA-232 (RS-232)	Serial Communications Protocol using three or more signal lines, intended for short distances. Concerning RS232D and RS232C, the letters C or D refer to the physical connector type. D specifies the RJ-11 connector where a C specifies a DB25 type connector.
	EIA-422 (RS-422)	Serial Communications Protocol using four signal lines.
	EIA-485 (RS-485)	Serial Communications Protocol requiring only two signal lines. Can allow up to 32 devices to be connected together in a daisy-chained fashion.
	EMF	Electro-Motive Force.
	EMI	Electro-Magnetic Interference.
	ESD	Electro-Static Discharge.
	EU	Engineering Units. Units of measure, such as MCF/DAY.
F		
	FCC	Federal Communications Commission. See http://www.fcc.gov.
	FET	Field Effect Transmitter.
	Firmware	Internal software that is factory-loaded into a form of ROM. In a ROC, the firmware supplies the software used for gathering input data, converting raw input data values, storing values, and providing control signals.
	FlashPAC module	ROM and RAM module for a ROC300-Series unit that contains the operating system, applications firmware, and communications protocol.
	Flash ROM	A type of read-only memory that can be electrically re-programmed. It is a form of permanent memory (requires no backup power). Also called Flash memory.
	FloBoss	A microprocess-based device that provides flow calculations, remote monitoring, and remote control. A FloBoss is a type of ROC.
	FM	Factory Mutual.
	Force	Manually write an ON/OFF, True/False, or 1/0 value to a coil.
	FPV	Compressibility Factor.
	FSK	Frequency Shift Keypad.
	FST	Function Sequence Table, a type of user-written program in a high-level language designed by Emerson Process Management's Flow Computer Division.
	Ft	Foot or feet.
G	ì	
	GFA	Ground Fault Analysis.
	GND	Electrical ground, such as used by the ROC's power supply.

**GP** Gauge Pressure.

Η		
	HART	Highway Addressable Remote Transducer.
	Holding Register	Modbus term for an analog output number value to be read.
	Hw	Differential pressure.
	Hz	Hertz.
I,	J	
	IC	Integrated Circuit. Also, Industry Canada (more recently known as Measurement Canada), an organization that grants custody transfer approvals on certain ROC units.
	ID	Identification.
	IEC	Industrial Electrical Code or International Electrotechnical Commission. See http://www.iec.ch.
	IEEE	Institute of Electrical and Electronic Engineers. A professional organization that, in conjunction with the International Standards Organization (ISO), establishes and maintains the Open System Interconnection (OSI) reference model and an international standard for the organization of local area networks (LANs). Refer to http://www.ieee.org.
	IMV	Integral Multiplier Value, used in AGA3 (orifice) calculations.
	Input	Digital input, a bit to be read.
	Input Register	Input numeric value to be read.
	Local Port	Also LOI; the serial EIA-232 (RS-232) port on the ROC through which local communications are established, typically for configuration software running on a PC.
	I/O	Input/Output.
	I/O Module	Module that plugs into an I/O slot on a ROC to provide an I/O channel.
	IRQ	Interrupt Request. Hardware address oriented.
	ISO	International Standards Organization. See http://www.iso.ch.
	IV	Integral Value.
K		
	КВ	Kilobytes.
	KHz	KiloHertz.
L		
	LCD	Liquid Crystal Display.
	LDP	Local Display Panel, a display-only device that plugs into ROC300 (via a parallel interface cable) used to access information stored in the ROC.
	LED	Light-Emitting Diode.
	Logical Number	The point number the ROC and ROC Plus protocols use for I/O point types are based on a physical input or output with a terminal location; the point numbers for all other point types are "logical" and are simply numbered in sequence.
	LNK	Ethernet has linked.
	LOI	Local Operator Interface (or Local Port). Refers to the serial EAI-232 (RS-232) port on the ROC through which local communications are established, typically for configuration software running on a PC.
	LPM	Lightning Protection Module; a device that provides lightning and power surge protection for ROCs.
LRC Longitudinal Redundancy Checking error checking.

#### Μ

m	Meter.	
mA	Milliamp(s); one thousandth of an ampere.	
MAC Address	Media Access Control Address; a hardware address that uniquely identifies each node of a network.	
Manual mode	Ianual mode For a ROC, indicates that the I/O scanning has been disabled.	
MAU	Medium Attachment Unit.	
MCU	Master Controller Unit.	
Modbus	A popular device communications protocol developed by Gould-Modicon.	
MPU	Micro-Processor Unit.	
mm	Millimeter.	
MMBTU	Million British Thermal Units.	
msec	Millisecond, or 0.001 second.	
MVS	Multi-Variable Sensor. A device that provides differential pressure, static pressure, and temperature inputs to a ROC for orifice flow calculations.	
mV	Millivolts, or 0.001 volt.	
mW	Milliwatts, or 0.001 watt.	

## Ν

NEC	National Electrical Code.
NEMA	National Electrical Manufacturer's Association. See http://www.nema.org.
0	
ОН	Off-Hook modem communications signal.
Off-line	Accomplished while the target device is not connected (by a communications link). For example, "off-line configuration" refers to configuring an electronic file that is later loaded into a ROC.
Ohms	Units of electrical resistance.
On-line	Accomplished while connected (by a communications link) to the target device. For example, "on-line configuration" refers to configuring a ROC800-Series unit while connected to it, so that you can view the current parameter values and immediately load new values.
Opcode	Type of message protocol the ROC uses to communicate with the configuration software, as well as host computers with ROC driver software.
Operator Interface	Generally, a method allowing a human operator to interact with a device. Also LOI or Local Port; the serial EIA-232 (RS-232) port on the ROC through which local communications are established, typically for configuration software running on a PC.
Orifice meter	A mechanical device that permits calculation of differential flow. Also, a meter that records the flow rate of gas through a pipeline. The flow rate is calculated from the pressure differential created by the fluid passing through an orifice of a particular size and other parameters.
P, Q	
Parameter	A property of a point that typically can be configured or set. For example, the Point Tag ID is a parameter of an Analog Input point. Parameters are normally edited by using

# F

	configuration software running on a PC.	
PC	Personal Computer.	
Pf	Flowing pressure.	
P/DP	Pressure/Differential Pressure.	
PI	Pulse Input.	
PID	Proportional, Integral, and Derivative control feedback action.	
PIT	Periodic Timer Interrupt.	
PLC	Programmable Logic Controller.	
Point	Software-oriented term for an I/O channel or some other function, such as a flow calculation. Points are defined by a collection of parameters.	
Point Number	The physical location of an I/O point (module slot and channel) as installed in the ROC.	
Point Type	Defines the database point to be a specific type of point available to the system. The point type determines the basic functions of a point.	
Preset	Number value previously determined for a register.	
PRI	Primary PID control loop.	
Protocol	A set of standards that enables communication or file transfers between two computers. Protocol parameters include baud rate, parity, data bits, stop bit, and the type of duplex.	
PSTN	Public Switched Telephone Network.	
PT	Process Temperature.	
PTT	Push-to-Talk signal.	
Pulse	Transient variation of a signal whose value is normally constant.	
Pulse Interface module	A module that provides line pressure, auxiliary pressure, and pulse counts to a ROC.	
PV	Process Variable or Process Value.	

R

Rack	A row of slots on a ROC into which I/O modules can be plugged. Racks are given a letter to physically identify the location of an I/O channel (such as "A" for the first rack). Built-in I/O channels are assigned a rack identifier of "A" while diagnostic I/O channels are considered to be in "E" rack.
RAM	Random Access Memory. RAM is used to store history, data, most user programs, and additional configuration data.
RBX	Report-by-exception. RBX always refers to Spontaneous RBX in which the ROC contacts the host to report an alarm condition.
RR	Results Register; stores the Signal Value Analog (SVA).
RFI	Radio Frequency Interference.
RI	Ring Indicator modem communications signal.
ROC	Remote Operations Controller microprocessor-based unit that provides remote monitoring and control.
ROCLINK 800	Microsoft® Windows®-based software used to configure functionality in ROC units.
ROM	Read-only memory. Typically used to store firmware. Flash memory.
Rotary Meter	A positive displacement meter used to measure flow rate.
RTC	Real-Time Clock.
RTD	Resistance Temperature Device.
RTS	Ready to Send modem communications signal.

	RTU	Remote Terminal Unit.
	RTV	Room Temperature Vulcanizing, typically a sealant or caulk such as silicon rubber.
	RS-232	Serial Communications Protocol using three or more signal lines, intended for short distances. Also referred to as the EIA-232 standard.
	RS-422	Serial Communications Protocol using four signal lines. Also referred to as the EIA-422 standard.
	RS-485	Serial Communications Protocol requiring only two signal lines. Can allow up to 32 devices to be connected together in a daisy-chained fashion. Also referred to as the EIA-485 standard.
	RX or RXD	Received Data communications signal.
S		
	Script	An uncompiled text file (such as keystrokes for a macro) that a program interprets in order to perform certain functions. Typically, the end user can easily create or edit scripts to customize the software.
	Soft Points	A type of ROC point with generic parameters that can be configured to hold data as desired by the user.
	SP	Setpoint, or Static Pressure.
	SPI	Slow Pulse Input.
	SPK	Speaker.
	SRAM	Static Random Access Memory. Stores data as long as power is applied; typically backed up by a lithium battery or supercapacitor.
	SRBX	Spontaneous Report-By-Exception. SRBX always refers to Spontaneous RBX in which the ROC contacts the host to report an alarm condition.
	SVA	Signal Value Analog. Stored in the Results Register, it is the analog value that is passed between functions in an FST.
	SVD	Signal Value Discrete. Stored in the Compare Flag, it is the discrete value that is passed down the sequence of functions in an FST.
	System Variables	Configured parameters that describe the ROC; set using ROCLINK software.
Т		
	T/C	Thermocouple Input.
	TCP/IP	Transmission Control Protocol/Internet Protocol.
	TDI	Time Duration Input.
	TDO	Time Duration Output.
Tf Flowing temperature.		Flowing temperature.
	TLP	Type (of point), Logical (or point) number, and Parameter number.
	TX or TXD	Transmitted Data communications signal.
	Turbine meter	A device used to measure flow rate and other parameters.
U		
	Upload	Transmit data, a file, or a program from the ROC to a PC or other host.
V	-Z	
	V	Volts.

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If you have comments or questions regarding this manual, please direct them to your local sales representative or contact:

Emerson Process Management Remote Automation Solutions Marshalltown, IA 50158 U.S.A. Houston, TX 77065 U.S.A. Pickering, North Yorkshire UK Y018 7JA Website: www.EmersonProcess.com/flow

